16714

2 4 0539

REMOVAL ACTION FIELD INVESTIGATION WORK PLAN PHASE II

for the

SAAD TROUSDALE DRIVE SITE
Nashville, Tennessee

Submitted to:

USEPA Region IV

Atlanta, Georgia

Prepared by:

DRE Geologic Services, Inc.

for the

Saad Site Steering Committee

July 1992

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1.0 INTRODUCTION

This Work Plan was prepared on behalf of the Saad Site Steering Committee in conjunction with the Administrative Order by Consent (AOC), EPA Docket No: 94-32-C, dated August 12, 1992 to perform additional removal activities at the Site. The Work Plan provides background information developed during the Removal Action/Field Investigation (RA/FI) conducted in 1991 and defines the scope and objectives of additional activities to be performed.

1.1 Background

The Saad Site Steering Committee was organized in January/February 1990 to address requirements of the United States Environmental Protection Agency (USEPA) as described in the AOC dated April 11, 1990. The previous AOC contained work requirements related to the removal of on-site tanks, drums and associated contents, the investigation and limited sampling of a potential sinkhole, and preparation of a report containing response action alternatives. With the submittal of the RA/FI Report (dated March 1992), all requirements of the April 11, 1990 AOC have been met.

1.2 History and Previous Removal Activities

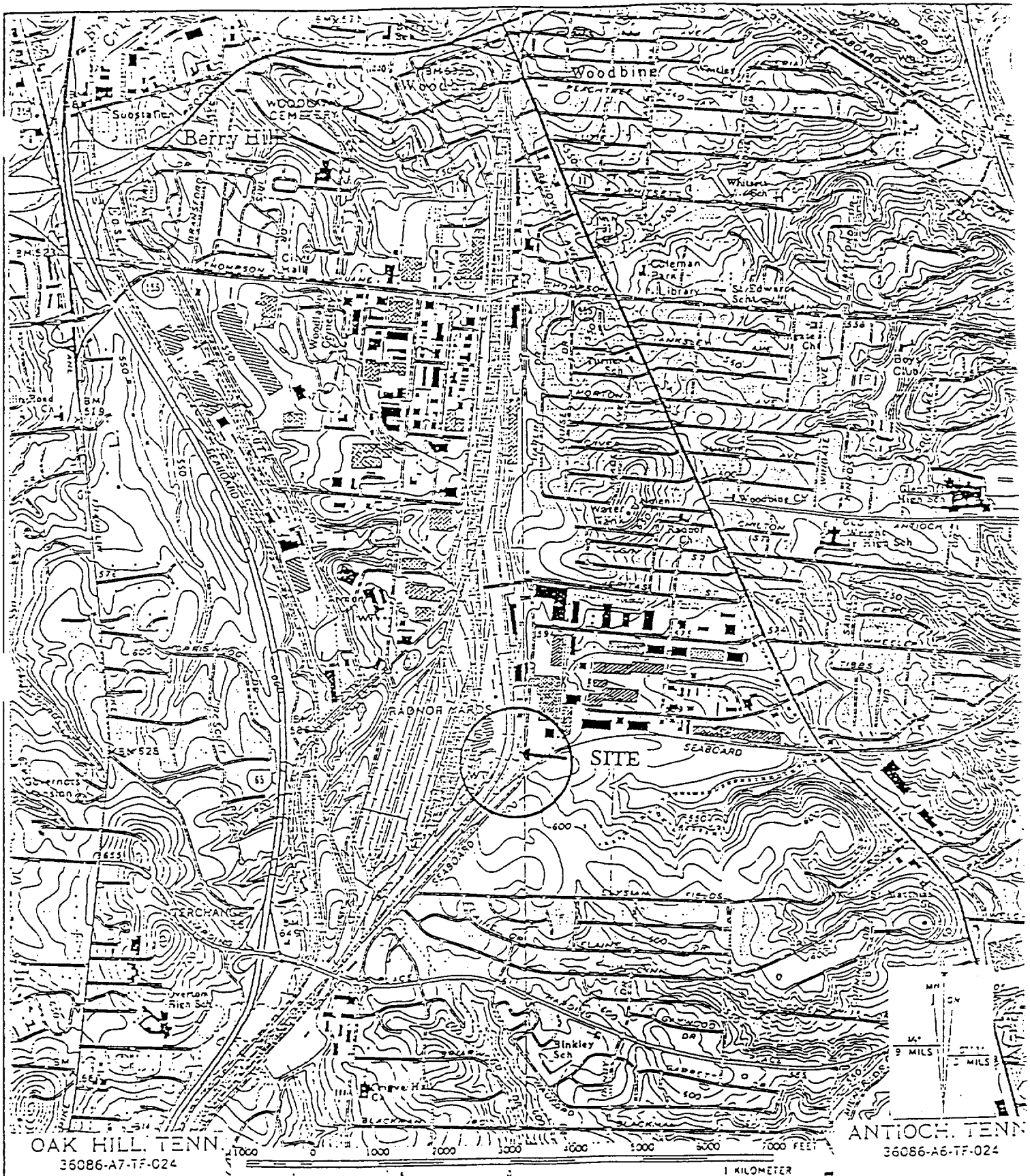
All past removal and investigatory activities conducted at the Site on behalf of the Saad Site Steering Committee were completed pursuant to and in conformance with the requirements of the USEPA's AOC dated April 11, 1990 with the approval and oversight by the USEPA, and consistent with the National Contingency Plan (NCP). Previous response actions conducted prior to and during the RA/FI have resulted in the removal of four aboveground tanks, two sumps and an Oil/Water Separator (OWS) System. Response actions to date have resulted in the removal and disposal of, 144,700 lbs of hazardous waste by incineration, 24,800 gallons of nonhazardous liquids for treatment, 105 drums of nonhazardous materials, 16 drums of hazardous materials and 100 cubic yards of nonhazardous debris.

The Site has been investigated and characterized via soil borings, trenching, test pits, and a geophysical survey. Subsurface soil samples have been collected for geotechnical and chemical analysis. Conclusions of the March 1992 RA/FI Report were:

- Removal activities conducted have resulted in significant reduction and/or elimination of toxicity, mobility, and volume of hazardous substances. All surface and subsurface debris and material that triggered the initial CERCLA response action have been removed.
- The former settling basin on the southwest corner of the site is not a geologic sinkhole.
- The site does not significantly contribute to area stormwater runoff or flooding problems.
- Based on data collected, soil contaminants appear to be limited primarily to ethylbenzene, toluene, xylene, and trichloroethylene. The detection of these compounds above target response levels (TRLs) was limited to four samples, all located on the southwest portion of the site.

1.3. General Site Description

The Site is located at 3655 Trousdale Drive in Nashville, Tennessee as presented in Figure 1-1, Site Location Map. The Site Location Map illustrates that the immediate vicinity is a very industrialized sector of Nashville with the Allied Industrial Park to the northeast and the site itself within the East Radnor Industrial Subdivision. The Site covers approximately 0.4 acres of property and includes an on-site building which is leased to and occupied by LTD Body Shop, an automobile body repair shop. The Site is owned by Ellis and Kathy Saad and formerly was used as an oil recycling business during the 1970's and early 1980's by John P. Saad and Sons, Inc. The Site is bounded on the north by Klein's Custom Coach Co. Inc., on the south by Franklin Brick Co., on the east by Trousdale Drive, and on the west by the CSX Railroad Radnor Yard property as depicted on Figure 1-2, Site Map.



OAK HILL, TENN.
36086-A7-TF-024
1968
PHOTOREVISED 1983
DMA 3656 III SE-SERIES V841

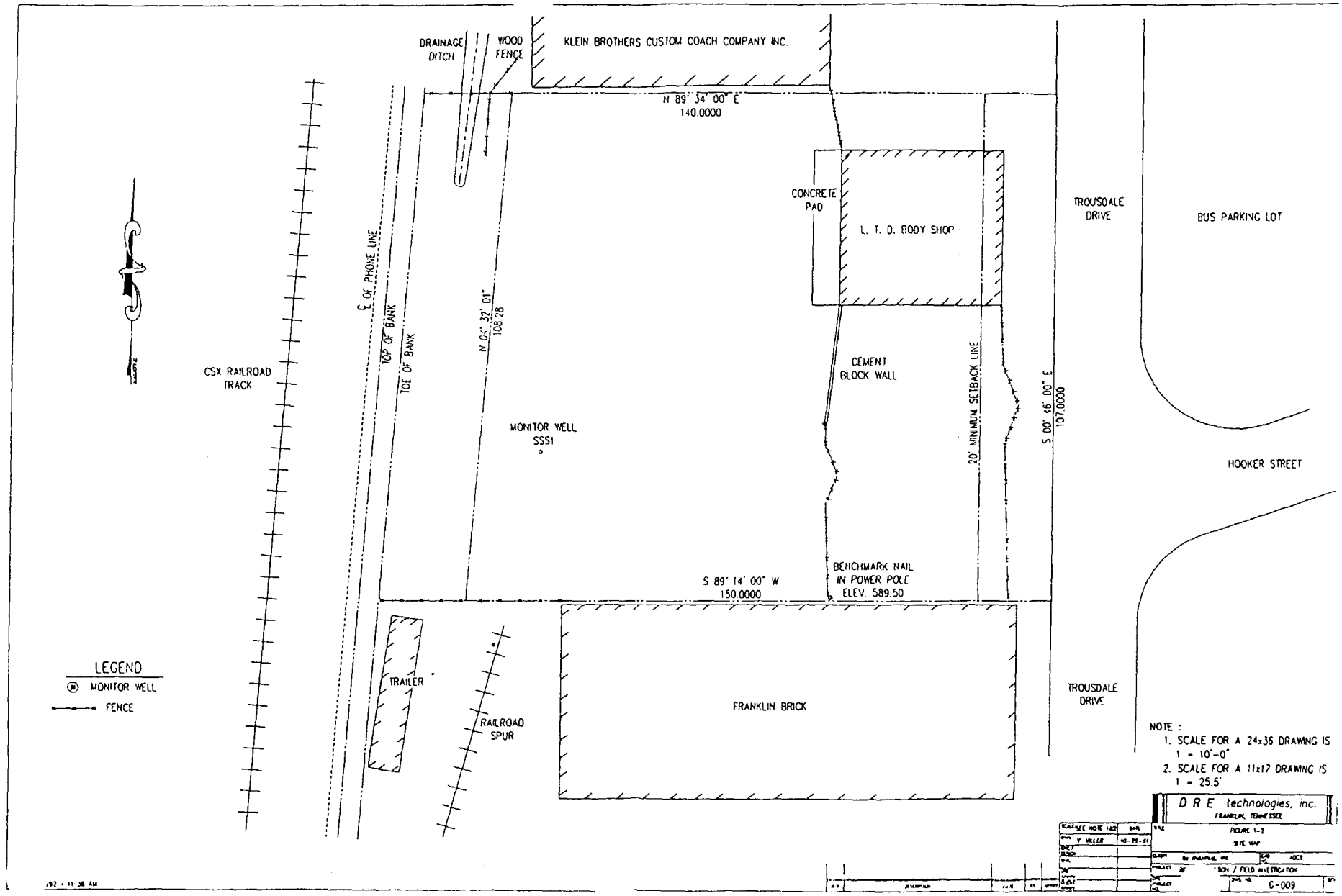
ANTIOCH, TENN.
36086-A6-TF-024
1968
PHOTOREVISED 198
DMA 3656 II SW-SERIES V

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Site Location Map
SAAD Trousdale Drive Site
Nashville, Tennessee

PROJECT # 4008
SCALE: 1:24,000
FIGURE # 1-1

D R E TECHNOLOGIES
FRANKLIN, TENNESSEE


DRAINAGE DITCH
WOOD FENCE
KLEIN BROTHERS CUSTOM COACH COMPANY INC.
N 89° 34' 00" E
140.0000
CONCRETE PAD
L. T. D. BODY SHOP
TROUSDALE DRIVE
BUS PARKING LOT
℄ OF PHONE LINE
TOP OF BANK
TOE OF BANK
N 04° 32' 01" E
108.28
CSX RAILROAD TRACK
CEMENT BLOCK WALL
20' MINIMUM SETBACK LINE
S 00° 46' 00" E
107.0000
MONITOR WELL
SSS1
HOOKER STREET
BENCHMARK NAIL IN POWER POLE ELEV. 589.50
S 89° 14' 00" W
150.0000
TRAILER
RAILROAD SPUR
FRANKLIN BRICK
TROUSDALE DRIVE
LEGEND
MONITOR WELL
FENCE
NOTE :
1. SCALE FOR A 24x36 DRAWING IS 1 = 10'-0"
2. SCALE FOR A 11x17 DRAWING IS 1 = 25.5'
D R E technologies, inc.
FRANKLIN, TENNESSEE
FIGURE 1-2
SITE MAP
C-009

1.3.1 Topography

The Saad Site is located at an elevation of approximately 589 feet above mean sea level and is relatively flat with less than two feet of elevation variation. The site gently slopes to drain surface water in two directions; the western portion of the site drains toward the swale located at the base of the steep bank below Radnor Yards and the eastern portion of the Site drains as runoff toward Trousdale Drive. A slight depression exists near the center of the Site as a result of the removal of the OWS system in 1991.

Previous investigations and conversations with representatives of the Metropolitan Nashville - Davidson County Stormwater Department indicate that ponding and stormwater runoff problems along Trousdale Drive have existed for years. There is no existing stormwater drainage plan for the Trousdale Drive area.

1.3.2 Soils and Vadose Zone

The RA/FI Report defined the Site's subsurface conditions. The soil/vadose zone at the Site consists of two primary horizons: an upper horizon of fill material and an underlying horizon of native soils. The upper zone contains significant quantities of debris fill from the surface to approximately thirteen (13) feet below grade. The upper 10-13 feet of material consists of oil-stained dark gray, sandy, silty clay backfill with large limestone boulders scattered throughout (estimated 30 percent by volume) with additional amounts of timber, bricks, and gravel.

A "concrete pad" of variable thickness (1.5 to 7.5 feet) has been traced at variable depths (near surface to 9 feet) in the subsurface from the western edge of the Franklin Brick Building to portions of the Saad property. Below the "concrete pad" the soils are dark gray, moist to saturated sandy, silty clays. Limestone boulders and miscellaneous debris were not encountered below the "concrete pad". Several geotechnical samples were collected from the underlying soil horizon. Permeabilities

for these soils ranged from 1.8×10^{-7} cm/sec to 9.5×10^{-9} cm/sec, which indicate low soil permeability.

Based on the analytical data evaluation, contamination extends to the soil/bedrock interface, approximately 20 feet below grade. The most frequently detected compounds at elevated concentrations were ethylbenzene, toluene, xylene, and trichloroethylene. Indicator compounds for the Site were developed in reference to the proposed Tennessee Industrial Soils Cleanup Levels (TISCLs). The most frequently detected compounds above TISCLs, their associated Target Response Levels based on the TISCLs and the frequency of detection during RA/FI activities are presented in Table 1-1.

1.3.3 Geology

The Site is underlain by the upper Ordovician Bigby - Cannon Limestone. This limestone consists of three facies, of which the Bigby Limestone is predominant in the Site vicinity. The Bigby Limestone is a medium light gray to brownish-gray, coarse-grained medium bedded calcarenite. The Bigby-Cannon does weather to form sinkhole in places; however, widening of vertical joints is the more prevalent form of solution weathering in the Bigby-Cannon. This limestone has a high phosphate content and weathers to form some of the deeper clayey soils in the area.

Bedrock was encountered during the July 1991 RA/FI in several of the investigatory soil borings/corings. Depth to bedrock ranged from 16 to 23 feet below ground surface and the bedrock surface was found to dip slightly to the south. Based on depth to bedrock, it appears the bedrock surface is relatively flat-lying throughout the Site. Structural relief of the bedrock surface is minimal, which indicates that a geologic sinkhole, or collapse feature is not present. The bedrock samples collected during the July 1991 RA/FI were described as gray, thinly bedded, stylolitic limestone.

TABLE 1-1

INDICATOR CHEMICALS FOR THE SAAD TROUSDALE DRIVE SITE
BASED ON COMPARISON
WITH
PROPOSED TENNESSEE INDUSTRIAL SOILS CLEANUP LEVELS (TISCLs)

Compound	Number Locations Exceeding TISCLs	CONCENTRATION, MG/KG	
		Maximum Detected Concentration during RA/FI	Proposed TISCLs
VOCs			
Ethylbenzene	3/18	280	20
Toluene	3/18	4100	40
Xylene	4/18	990	20
Trichloroethylene	3/18	650	0.5
Tetrachloroethylene	1/18	4	0.5
METALS			
Cadmium	2/18	26.6	10
Lead	1/18	790	500
PCB 1248	1/18	437	10

1.4 Objectives

The primary objective of this Work Plan is to detail the project scope to address the requirements of the August 12, 1992 AOC. The following major activities will be performed to comply with the AOC requirements:

- Perform a subsurface drum search, by limited trenching, and remove, sample, and dispose of intact drums found during excavation.
- Confirm the presence and extent of potential PCB/Pb contamination adjacent to the south face of the previously excavated OWS pit.
- Remove PCB/Pb contaminated soils (from the confirmation trench) above Target Response Levels (TRLs) for on-site treatment as necessary and/or off-site disposal.
- Obtain additional vadose zone analytical data in designated areas for further site characterization.
- Reevaluate past characterization data in conjunction with the additional site characterization data and proposed TRLs for supplemental evaluation of response alternatives to include the evaluation of treatability study requirements.
- Prepare and submit a detailed response alternative report with recommendations to the USEPA.

1.5 Project Organization/Project Team

This section provides and presents the project organization and the corresponding responsibilities to facilitate communication and efficient project performance. All tasks in this work plan will be conducted in accordance with the responsibilities and within the lines of communication as identified in the Project Team Organization illustrated on Figure 1-3 and as described below:

- SAAD Site Steering Committee (SSSC) - The respondent organization which has entered into the AOC and is responsible for implementation of the requirements of the Order.
- SAAD Site Technical Committee (SSTC) - This committee is comprised of technical/legal representation through which the project coordinator

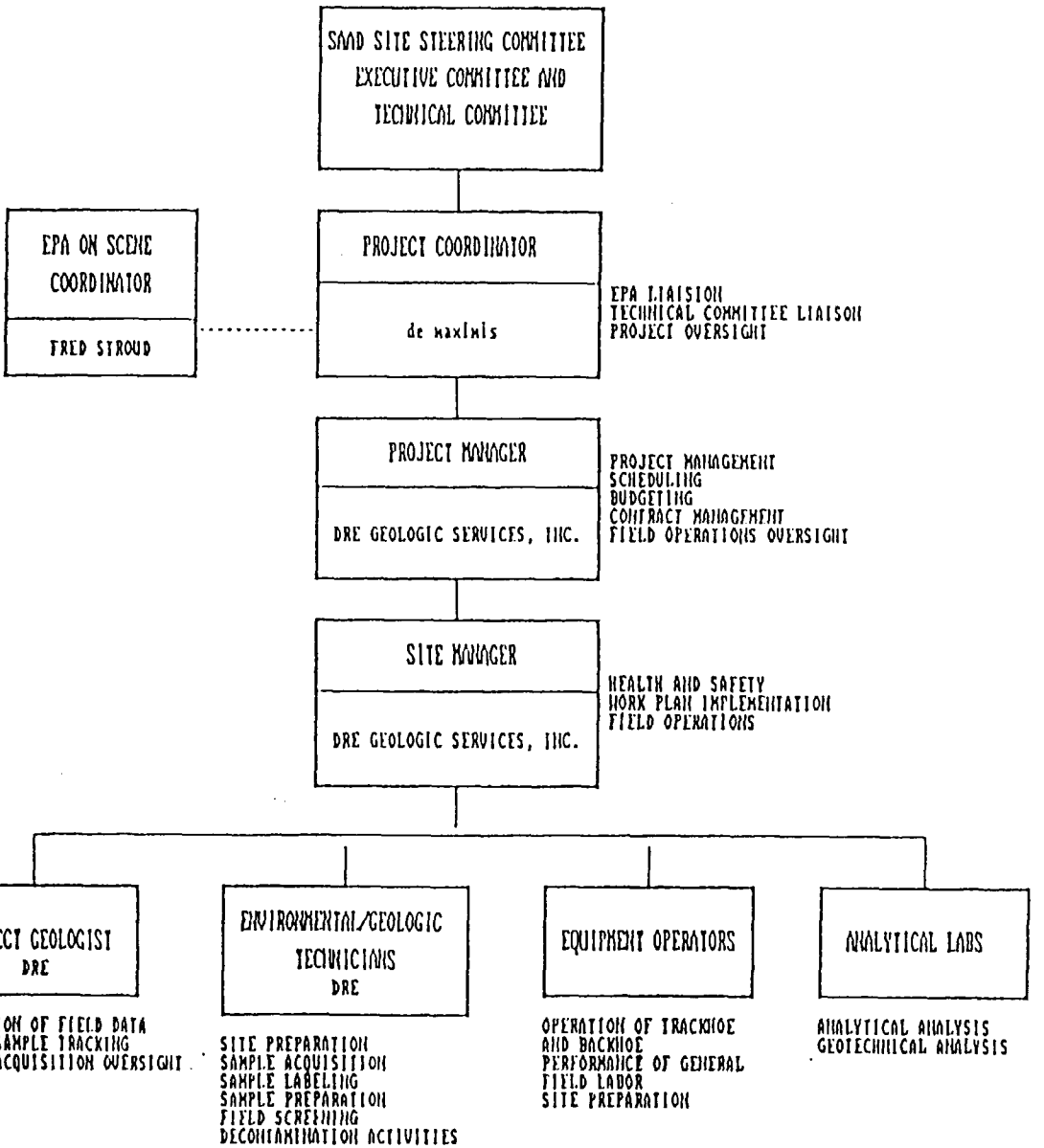


FIGURE 1-3

PROJECT TEAM FOR THE REMOVAL ACTION/FIELD INVESTIGATION - PHASE II
SAAD SITE, TROUSDALE DRIVE, NASHVILLE, TENNESSEE

reviews, develops, and approves the technical approach and direction prior to presentation to the respective entities *i.e.*, SSSC, EPA etc.

- USEPA On-Scene Coordinator (OSC) - EPA's designated representative at the site (Fred Stroud).
- Project Coordinator - Bennie Underwood of de maximis, inc. has been retained by the SSSC to serve as Project Coordinator. de maximis is responsible for technical committee liaison, project oversite, and is the committee liaison between the SSSC committee, the regulatory agency, and the Project Management Team. The Project Coordinator will serve as the focal point for all communication between the SSSC, SSTC, DRE and the EPA.
- Project Manager/Site Manager - DRE Geologic Services, Inc. has been retained to function as the Project Manager/Site Manager. Joe Putnam (DRE Geologic Services, Inc.) is responsible for overall project management to include: scheduling, budgeting, contract management, implementation of the Work Plan, direction of field operations, and oversite of the health and safety program.
- Health and Safety Officer - The site manager will serve as the Health and Safety Officer and will be responsible for implementing the previously approved Safety Plan and amendments to the Plan.
- Field Geologist, Sampling Technicians, and Equipment Operators - Personnel associated with these positions will be responsible for implementation of the Work Plan activities associated with acquisition and evaluation of field samples, site geologic descriptions, field lab analysis, field operations, etc.
- Analytical laboratory - Specialized Assays of Nashville, Tennessee will perform the laboratory analysis for the project. The Lab will provide sample containers and be responsible for ensuring that samples acquired during on-site activities are received, documented and the results submitted to the Contractor in accordance with all required procedures.

1.6 Site Management

Site management and control will be the responsibility of the DRE Geologic Services, Inc., Site Manager. Site management responsibilities include the implementation of the those measures required to ensure that chemical and physical hazards to workers and the public are reduced, and that work activities are facilitated. Components of site management will include:

- Establishment of work zones and personnel protective equipment based on site specific conditions.
- Enforcement of decontamination procedures for personnel and equipment.
- Site security measures, both temporary and permanent to facilitate protection of human health and environment.
- Enforcement of health and safety protocols.
- Use of appropriate engineering controls as necessary to protect human health and the environment.

1.7 Site Work Zone Definition

During site mobilization, the Site Manager and/or the Health and Safety Officer will establish three site work zones (which may be task specific). The Work Plan includes site work zone definitions as follows with reference to the previously approved July 1991 RA/FI Work Plan. The three site work zones and associated levels of protection are as follows:

Zone	Protection
Support Zone	None
Contaminant Reduction Zone	Level D, C
Exclusion Zone	Level D, C, or B

The boundaries of these zones will be clearly marked with entry restricted to authorized personnel. Access to the Exclusionary Zone will only be through a decontamination area located in the Contaminant Reduction Zone. The work plan designates the areas in which site trenching, and sampling activities are being performed as the Exclusionary Zone. A Contaminant Reduction Zone (CRZ) will be designated around the perimeter of the Exclusion Zone. The Support Zone will be designated outside the CRZ for personnel rest, liquid replenishment, equipment storage, etc.

Access to the site will be controlled. The existing security fence will be used and expanded as necessary to restrict access to the entire site. The Site Manager will be responsible for controlling access during working hours. A log will be maintained of each person entering and leaving the site. An authorized personnel list will be maintained at the site headquarters. Personnel not prelisted will require clearance from the Project Coordinator and/or clearance by the SSSC or SSTC prior to entry into the work zones. All personnel entering the Site will be required to present certification that they have the training requirements in accordance with 29 CFR 1910 and are familiar with the Site Health and Safety Plan.

1.8 Health and Safety/Quality Assurance and Control

Work will be performed in accordance with the revised previously approved HSP and QAPP for RA/FI activities. Any additions or modifications to these project plans as a result of specific activities or equipment are discussed in the appropriate sections of this Work Plan or provided in Appendices I & II of this Work Plan.

2.0 MOBILIZATION/SITE PREPARATION

Site mobilization and preparation prior to initiating the Work Plan Tasks will include and/or require the following:

(1) Written approval of Work Plan from EPA

(2) LTD Auto Body Shop closure, to include removal of all associated debris, materials, autos, auto parts, solvents, etc. by the current owner/tenant, to allow the establishment of on-site headquarters with appropriate utilities and communication systems, as well as site security control. Closure will allow access to body shop properties for project equipment and material storage, and designated investigatory activities.

(3) Signed access agreements as appropriate to allow performance of work plan tasks and access to off-site secured staging areas as required based on site specific conditions.

(4) Installation of additional security fencing, gates, and locks as necessary to restrict access to the entire site.

(5) Construction of a designated site decontamination area located in the area of the parking/auto storage area of the body shop.

(6) Collection and containment of existing site surface debris for off-site disposal.

(7) Construction of designated fluid holding tank areas for trench water and decontamination waters.

(8) Remove existing concrete wall and security fencing to allow placement of equipment and site materials in the body shop area.

2.1 Transition and Security

Upon approval of the Work Plan, DRE will mobilize the necessary personnel, equipment, and materials to facilitate temporary site security necessary to perform site activities. Site security for field activities will be established following the closure of the body shop, and removal of all associated debris, materials, autos, auto parts, solvents, etc. by the current tenant/owner. Site security measures will include the following:

- Temporary fencing and placarding as necessary to restrict site access.

- Establishment of the Site command post which will be the designated entry into the Site.
- Establishment of the controlled entry program for site access.
- Evidence of site entry after working hours may require additional measures restricting site access.

Permanent security measures will be implemented after completion of all site activities. These security measures will include permanent perimeter fencing, security lighting, and placarding. The permanent security measures will be performed to comply with the AOC.

2.2 Site Work Zone Definition

The Work Zones and associated levels of personnel protection are discussed in Section 1.6. The three site work zones consist of the Exclusion Zone, the Contaminant Reduction Zone and the Support Zone. Areas in which site trenching, excavation and sampling are designated as the Exclusion Zone.

The Exclusion Zone is the area where contamination could occur. Exclusion Zones will be clearly marked and access control points will be limited to regulate the flow of personnel and equipment into and out of the zone.

The Contaminant Reduction Zone (CRZ) is the transition area between the potentially contaminated area and the clean area. This zone will include the decontamination area.

The Support Zone is the location of administration and other support functions needed to keep the operations in the Exclusion Zone and Contaminant Reduction Zone running smoothly.

2.3 Decontamination Facilities

Decontamination Facilities/Methods - A decontamination area will be located near the entrance to the Saad Site property within the CRZ and adjacent to the LTD Body Shop building. Water and electricity will be obtained from existing utilities at the LTD Body Shop. If necessitated by space limitations or access restrictions, the decontamination area may be relocated.

The decontamination area will consist of a shallow pit excavated with the backhoe. The pit and surrounding area will be lined with heavy duty plastic

sheeting designed to promote runoff of the rinse water into the pit. The waste waters will be pumped into an appropriate containment vessel for on-site storage and ultimate characterization for disposal. All cleaning of equipment will be conducted above the plastic sheeting. Upon completion of the sampling investigation activities, the pit will be backfilled with the same soils removed to construct the decontamination pad.

Detailed decontamination procedures and protocol are presented in Appendix IV.

2.4 Materials Handling and Staging

Materials handling and staging presents a significant potential difficulty for the efficient performance of the work tasks described in this plan due to space limitations. It is anticipated that removal of large quantities of soil, boulders and debris (expected to be encountered in the vadose zone) will be problematic due to the lack of available space on the 0.4 acre site. Of the 0.4 acre site, only a fraction will be available for staging of materials due to the presence of the on-site building and site equipment to be used during removal activities. Equipment requirements necessary for implementation of the work will include backhoe/track hoes for excavation of trenches, and segregation of trench materials, permanent and/or temporary decontamination equipment and areas, liquid storage vessels for decon fluids and trench water and a host of sampling and ancillary equipment (*i.e.*, equipment and space requirements). These factors will contribute to an increasingly small amount of area available to perform site activities.

Specific staging locations will be chosen based on site specific conditions. The concrete apron located immediately west of the L.T.D. Body Shop has been designated as the drum storage area. Soils/debris from trench excavation/characterization activities will be placed on plastic sheeting in areas to be determined by site specific conditions based on operating limitations of the excavation equipment and site safety. Soils/debris from PCB/Pb trenching will be placed on plastic in on-site areas to allow for effective segregation. Soil and debris will remain segregated until final disposition determinations are made

based on field screening and laboratory analysis. Staging areas will be located to allow for continuous site activity.

2.5 Field Office Facilities

For purposes of this Work Plan, it is assumed that the present LTD Body Shop building will be available for use as headquarters for operations and for storage of equipment and materials. If the building and surrounding area are unavailable, the implementation of this Work Plan will be delayed until this space becomes available for use.

3.0 FORMER OIL/WATER SEPARATOR (OWS) AREA - SOIL CHARACTERIZATION

3.1 Introduction

This section of the Work Plan describes the proposed activities to include limited trenching, field screening, and soil sampling necessary to determine the potential extent of PCB/Pb contamination in the area south of the former OWS system (See Figure 3-1, RA/FI Sample Location Map - July 1991). During performance of the July 1991 RA/FI Work Plan, the (OWS) System was excavated, decontaminated, and disposed of off-site. Two (2) soil samples, OWS-PN-01 (8 Ft. BGL) and OWS-PS-01 (10 Ft. BGL), were collected for analysis from the north and south side of the excavation pit, respectively. The southern sample, OWS-PS-01, indicated the presence of PCB and Pb above TRLs.

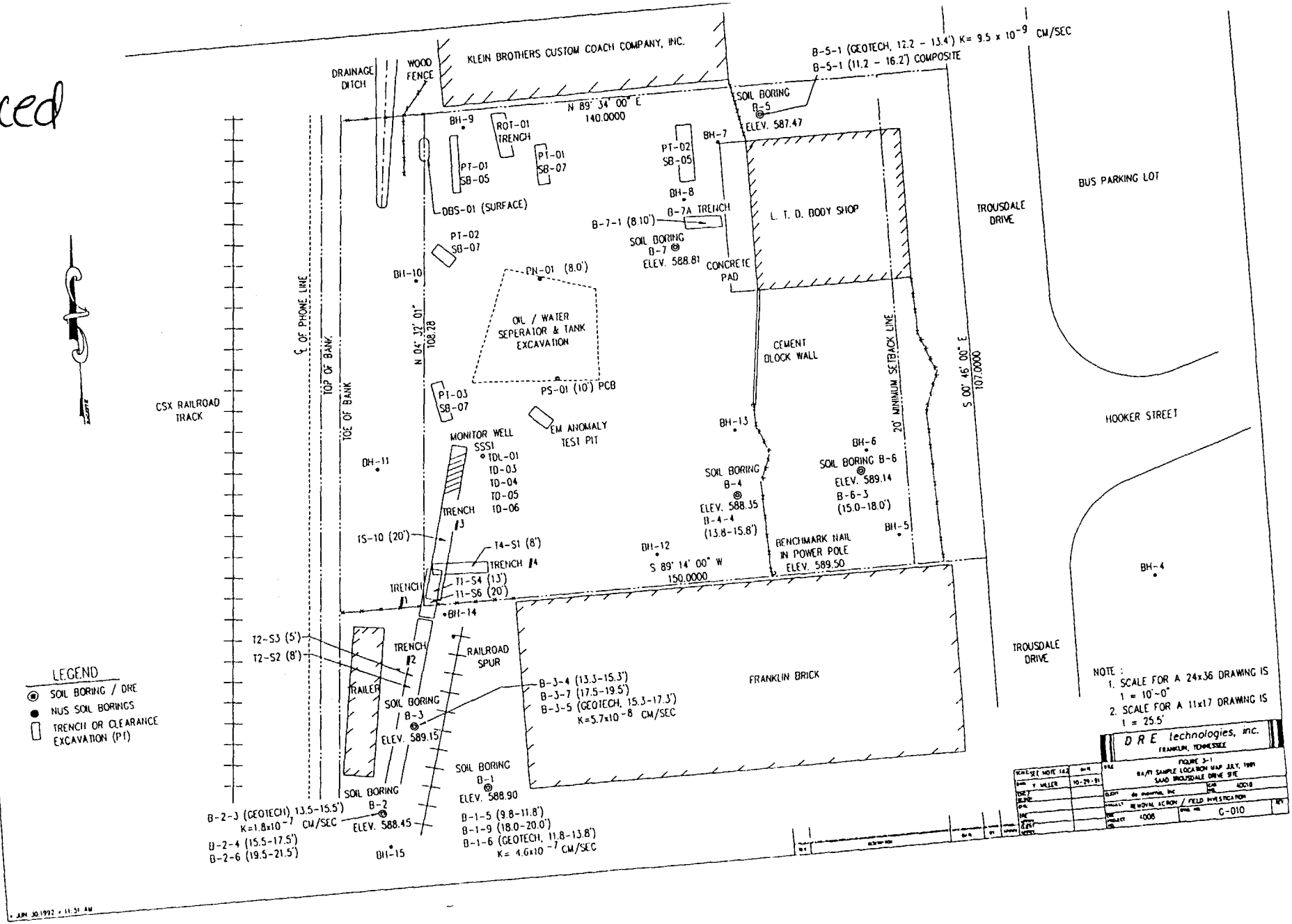
3.1.1 Previous Data Discussion

As previously mentioned, soil sample (OWS-PS-01) was found to contain PCB and Pb concentrations above TRLs. The TRL for PCB is 10 ppm and the TRL for Pb is 500 ppm. Sample OWS-PS-01 was found to contain a Pb concentration of 790 ppm and PCB 1248 concentration of 437 ppm. The sample collected along the north side of the OWS (OWS-PN-01) contained Pb at a concentration of 25.7 ppm and PCB was not detected. Sample OWS-PS-01 was the single data point obtained during the RA/FI where these compound concentrations were detected above TRLs.

3.2 Objectives

The objective of the former OWS System investigation is to conduct limited trenching, field screening, and soil sampling activities to confirm the single sample PCB/Pb results and determine the extent of PCB/Pb contamination in the vadose/unconsolidated zone (vertically and aerially) adjacent to the southern face of the OWS pit excavation. Any soils found above TRLs for PCB and/or Pb will be removed, segregated and staged for potential on-site treatment or off-site disposal. A supplementary objective is to obtain additional site characterization data for use in the proposed remedial alternatives analysis.

Reduced


KLEIN BROTHERS CUSTOM COACH COMPANY, INC.
DRAINAGE DITCH
WOOD FENCE
N 89° 34' 00" E
140.0000
B-5-1 (GEOTECH, 12.2 - 13.4') K= 9.5 x 10⁻⁹ CM/SEC
B-5-1 (11.2 - 16.2') COMPOSITE
SOIL BORING B-5
ELEV. 587.47
BH-9
ROT-01 TRENCH
PT-01 SB-05
PT-01 SB-07
PT-02 SB-05
BH-7
BH-8
DBS-01 (SURFACE)
B-7-1 (8.10')
B-7A TRENCH
L. T. D. BODY SHOP
SOIL BORING B-7
ELEV. 588.81
PT-02 SB-07
BH-10
PN-01 (8.0')
OIL / WATER SEPERATOR & TANK EXCAVATION
CONCRETE PAD
CEMENT BLOCK WALL
20' MINIMUM SETBACK LINE
S 00° 46' 00" E
107.0000
TROUSDALE DRIVE
BUS PARKING LOT
HOOKER STREET
N 04° 32' 01"
108.28
℄ OF PHONE LINE
TOP OF BANK
TOE OF BANK
CSX RAILROAD TRACK
PS-01 (10') PCB
PT-03 SB-07
EM ANOMALY TEST PIT
BH-13
BH-11
MONITOR WELL SSSI
TDL-01
TD-03
TD-04
TD-05
TD-06
TRENCH #3
SOIL BORING B-4
ELEV. 588.35
B-4-4 (13.8-15.8')
BH-6
SOIL BORING B-6
ELEV. 589.14
B-6-3 (15.0-18.0')
BH-5
TS-10 (20')
T4-S1 (8')
TRENCH #4
BH-12
S 89° 14' 00" W
150.0000
BENCHMARK NAIL IN POWER POLE
ELEV. 589.50
T1-S4 (13')
T1-S6 (20')
TRENCH #1
BH-14
BH-4
T2-S3 (5')
T2-S2 (8')
TRENCH #2
RAILROAD SPUR
TRAILER
SOIL BORING B-3
ELEV. 589.15
B-3-4 (13.3-15.3')
B-3-7 (17.5-19.5')
B-3-5 (GEOTECH, 15.3-17.3')
K=5.7x10⁻⁸ CM/SEC
FRANKLIN BRICK
SOIL BORING B-1
ELEV. 588.90
B-1-5 (9.8-11.8')
B-1-9 (18.0-20.0')
B-1-6 (GEOTECH, 11.8-13.8')
K= 4.6x10⁻⁷ CM/SEC
B-2-3 (GEOTECH) 13.5-15.5')
K=1.8x10⁻⁷ CM/SEC
SOIL BORING B-2
ELEV. 588.45
B-2-4 (15.5-17.5')
B-2-6 (19.5-21.5')
BH-15
LEGEND
SOIL BORING / DRE
NUS SOIL BORINGS
TRENCH OR CLEARANCE EXCAVATION (PT)
NOTE :
1. SCALE FOR A 24x36 DRAWING IS 1 = 10'-0"
2. SCALE FOR A 11x17 DRAWING IS 1 = 25.5'
DRE technologies, inc.
FRANKLIN, TENNESSEE
FIGURE 2-1
RA/FI SAMPLE LOCATION MAP JULY, 1991
SAAD TROUSDALE DRIVE SITE
REMOVAL ACTION / FIELD INVESTIGATION
G-010

3.3 Requirements and Assumptions

3.3.1 Access Agreements

Prior to conducting this task, access arrangements as necessary will be secured as provided for under the provisions of Section VI, paragraphs 16 and 26 of the AOC, to allow for off-site storage and staging of excavated materials as determined by site specific conditions.

3.3.2 Storage and Staging Requirements

All excavated soils and materials will be field and laboratory screened, segregated, staged, and treated as necessary to allow for final waste characterization and disposal. Based on field screening of excavated lifts, materials will be placed in separate piles from other debris and staged in a secured area, while waiting for confirmatory laboratory analysis. If positive results are detected, soils will remain segregated and secure until a decision is reached on potential on-site pretreatment and/or coordination for off-site disposal.

3.3.3 Criteria for Staging, Disposal

Field Screening for PCBs will be performed using the EnSys Rapid Immunoassay Screening (RIS) test method. The EnSys PCB RIS field analytical method allows for quick in-the-field assessments of PCBs that meet the EPA's data quality objective (DQO) levels 1 or 2. The test kits will be calibrated with a proposed lower end detection threshold of 10 ppm (TRL). Field screening data from the RIS will indicate positive or negative results. If screening results are positive, based on equipment standardization, [indicating PCB concentration greater than or equal to 10 ppm (above the PCB TRL)], samples will be collected from this interval

and submitted to the analytical laboratory for quantitative results and confirmation of PCB concentration. The test standard operating procedures and methods are provided in Appendix V.

Screening for Lead (Pb) will be performed at Specialized Assays Environmental Laboratory (Nashville, Tennessee) with prearranged service to allow for 3 to 4 hour turnaround of analytical samples. Soils and debris found to contain PCB and/or Pb above TRLs will be segregated and staged as necessary until a decision is reached regarding any on-site pretreatment or proper off-site disposal.

3.4 OWS Area PCB/Pb Characterization Procedures

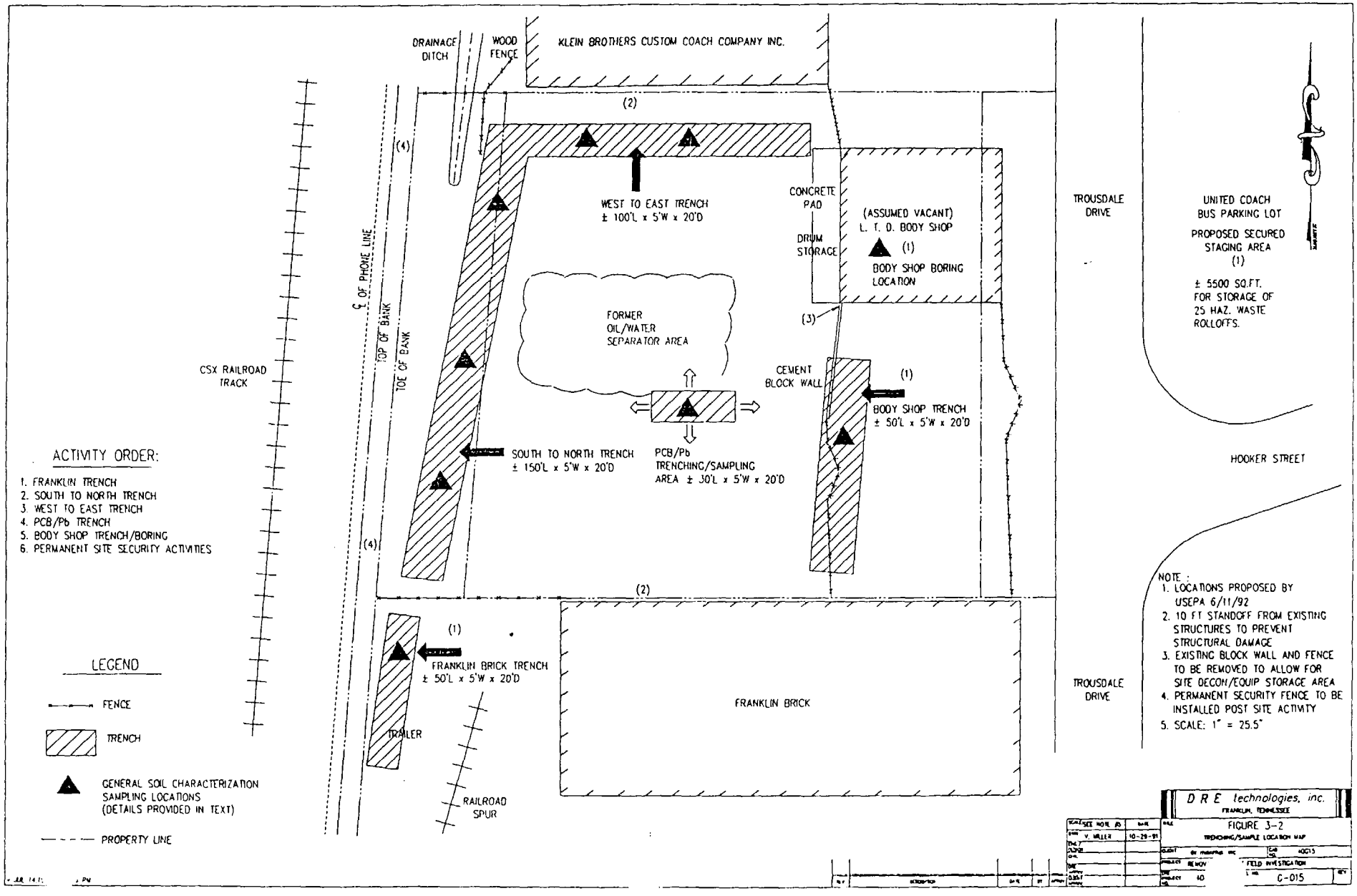
3.4.1 Initial Trench Dimensions

The initial PCB/Pb trench will be a maximum of ten feet (10) in length adjacent to the southern face of the former OWS pit. The maximum anticipated width is five feet (5'). Boulders and debris that are expected to be encountered in the subsurface may dictate the actual trench dimensions. The maximum anticipated depth is twenty feet (20') which is the maximum equipment capability and/or depth to bedrock. The PCB/Pb trench location is shown on Figure 3-2, Trenching/Sample Location Map.

3.4.2 Lift Size/Screening and Threshold

The trench will be excavated in five-foot (5) vertical intervals and in ten-foot (10) linear increments. Soil samples will be collected in sample jars and screened for volatile organic compounds with a photoionization detector (PID). Samples with the highest PID readings will be submitted to the lab for Target Analyte List/Target Compound List (TAL/TCL) analyses and Total Recoverable Hydrocarbon (TRPH) analysis. In addition, field screening for PCB will be performed at the rate of two (2) PCB screening per five-foot (5) vertical by ten-foot (10) linear lift increments for a total of eight samples per ten (10) linear foot trench sections, not including quality assurance samples. Analytical screening for Pb will occur at a rate of one sample per 5 vertical x 10 foot

Reduced


DRAINAGE DITCH
WOOD FENCE
KLEIN BROTHERS CUSTOM COACH COMPANY INC.
(2)
(4)
WEST TO EAST TRENCH
± 100'L x 5'W x 20'D
CONCRETE PAD
DRUM STORAGE
(ASSUMED VACANT)
L. T. D. BODY SHOP
(1)
BODY SHOP BORING LOCATION
TROUSDALE DRIVE
UNITED COACH BUS PARKING LOT
PROPOSED SECURED STAGING AREA (1)
± 5500 SQ.FT. FOR STORAGE OF 25 HAZ. WASTE ROLLOFFS.
℄ OF PHONE LINE
TOP OF BANK
TOE OF BANK
CSX RAILROAD TRACK
FORMER OIL/WATER SEPARATOR AREA
(3)
CEMENT BLOCK WALL
(1)
BODY SHOP TRENCH
± 50'L x 5'W x 20'D
SOUTH TO NORTH TRENCH
± 150'L x 5'W x 20'D
PCB/Pb TRENCHING/SAMPLING AREA ± 30'L x 5'W x 20'D
HOOKER STREET
ACTIVITY ORDER:
1. FRANKLIN TRENCH
2. SOUTH TO NORTH TRENCH
3. WEST TO EAST TRENCH
4. PCB/Pb TRENCH
5. BODY SHOP TRENCH/BORING
6. PERMANENT SITE SECURITY ACTIVITIES
NOTE:
1. LOCATIONS PROPOSED BY USEPA 6/11/92
2. 10 FT STANDOFF FROM EXISTING STRUCTURES TO PREVENT STRUCTURAL DAMAGE
3. EXISTING BLOCK WALL AND FENCE TO BE REMOVED TO ALLOW FOR SITE DECON/EQUIP STORAGE AREA
4. PERMANENT SECURITY FENCE TO BE INSTALLED POST SITE ACTIVITY
5. SCALE: 1" = 25.5'
LEGEND
FENCE
TRENCH
GENERAL SOIL CHARACTERIZATION SAMPLING LOCATIONS (DETAILS PROVIDED IN TEXT)
PROPERTY LINE
(1)
FRANKLIN BRICK TRENCH
± 50'L x 5'W x 20'D
TRAILER
FRANKLIN BRICK
TROUSDALE DRIVE
RAILROAD SPUR
DRE technologies, inc.
FRANKLIN, TENNESSEE
FIGURE 3-2
TRENCHING/SAMPLE LOCATION MAP
V. MILLER
10-29-91
FIELD INVESTIGATION
C-015

linear trench increment. Four hour laboratory analysis turn around time is required for Pb analysis. If PCB/Pb screening results indicate that the TRLs are not exceeded in the 10' x 5' x 20' trench, all characterization activities associated with this project phase will cease and final confirmatory samples will be collected for PCB analysis. If screening results indicate that the PCB TRL is exceeded confirmatory samples will be collected for PCB analysis and, trenching will continue in ten-foot (10) linear sections for a maximum of thirty (30) linear feet of trench.

3.4.3 Sampling

Table 3-1 presents the PCB/Pb Sampling Program for the former OWS System. This table presents the best case and worst case sampling and analytical procedures.

3.4.4 Staging/Segregation

Excavated soils and debris will be segregated and staged by lift based on the location of other site equipment placement. Soils will be secured while analytical screening results are being reviewed. Final placement of excavated soils will be based on field screen or laboratory analytical results.

3.4.5 Volatile Containment

Volatile suppressant barriers, *i.e.* material barriers or foams, will be available for use on staged materials, in the event that explosive limits (to be determined by Lower Explosive Limit/Oxygen Level [LEL/O_2] monitoring) or volatile concentrations above 10.0 ppm are found in the breathing zone for longer than a five (5) minute period. PID monitoring will performed continuously at the excavation area. Foam characteristics, as determined by manufacturer documents, including MSDS information, will be evaluated and approved by the Project Coordinator, Project Manager, and OSC prior to use at the site. Vapor suppressant material blankets are preferable for site use due to potential contamination of site soils from the foam chemical suppressant components.

TABLE 3-1

PCB/Pb SAMPLING PROGRAM - OIL WATER SEPARATOR TRENCH

Linear Feet of Trench East - West

Ft. Below Ground	10	20	30
0	FS/FSD Pb PID-HS	FS Pb PID-HS	FS Pb PID-HS
5	FS Pb PID-HS	FS Pb PID-HS	FS/FSD Pb PbD PID-HS
10	FS Pb PID-HS	FS/FSD Pb PID-HS	FS Pb PID-HS
15	FS/FSD Pb PID-HS	FS Pb PbD PID-HS	FS Pb PID-HS
20			

COMMENTS:

If PCB field screening results are greater than 10.0 ppm a confirmatory sample will be sent to laboratory for PCB analysis.

If all field screen samples for PCBs are negative, 4 samples will be obtained from the segregated soils area and sent to the laboratory to confirm the absence of PCBs above the TRLs.

Four samples with the highest PID headspace readings will be sent to the laboratory for TAL/TCL/TRPH analysis for site characterization. These samples may also serve as PCB/Pb confirmation.

LEGEND

FS - Field screen for PCB analysis
FSD - Field screen duplicate for PCB analysis
PID - HS - Photoionization Probe - Head space method
Pb - Lead
PbD - Lead duplicate
PCB - Polychlorinated biphenols

Total Samples:

12 field screen PCBs
4 field screen duplicates PCBs
12 Pb laboratory analyses
2 Pb duplicates
4 TAL/TCL/TRPH laboratory analyses
4 Confirmatory samples for PCBs

3.4.6 Removal of Liquids, Debris, Boulders

Trench water that inhibits excavation, found during trenching activities will be collected and pumped into a designated segregated fluid holding tank for analysis and characterization for off-site disposal. These fluids will not be commingled with decontamination waters, or waters from drum search/characterization trenches unless analytical data indicate compatibility for disposal.

Boulders and debris (non-soil) will be removed and segregated during excavation for potential off-site disposal based on site screening/sampling activities.

3.5 Disposal Coordination/On-Site Treatment

Excavated soils and materials found to exceed PCB/Pb TRLs by screening and analytical methods will be segregated for potential on-site pretreatment and/or potential off-site disposal. Analytical sample results will be evaluated for disposal and/or treatment options with consideration of TRLs, Land Disposal Restrictions (LDRs), and other criteria. A specified area will be required for hazardous materials storage and staging during pretreatment consideration and disposal coordination. The proposed evaluation process is presented per the attached Decision Tree, for PCB/Pb Contaminated Soil/Debris Figure 3-3.

3.5.1 Sampling and Analysis

The sampling and analysis program for the OWS area and the site as a whole is presented in Table 3-2. Analytical sampling for potential off-site disposal will be based on disposal facility requirements.

3.5.2 Approvals

Additional considerations to be made prior to disposal will include disposal and treatment criteria for RCRA subpart C and D; availability and capacity of disposal facilities, and EPA written concurrence and approval of disposal facilities and pretreatment methods prior to off-site shipment.

FIGURE 3-3
DECISION TREE FOR EXCAVATED SOILS

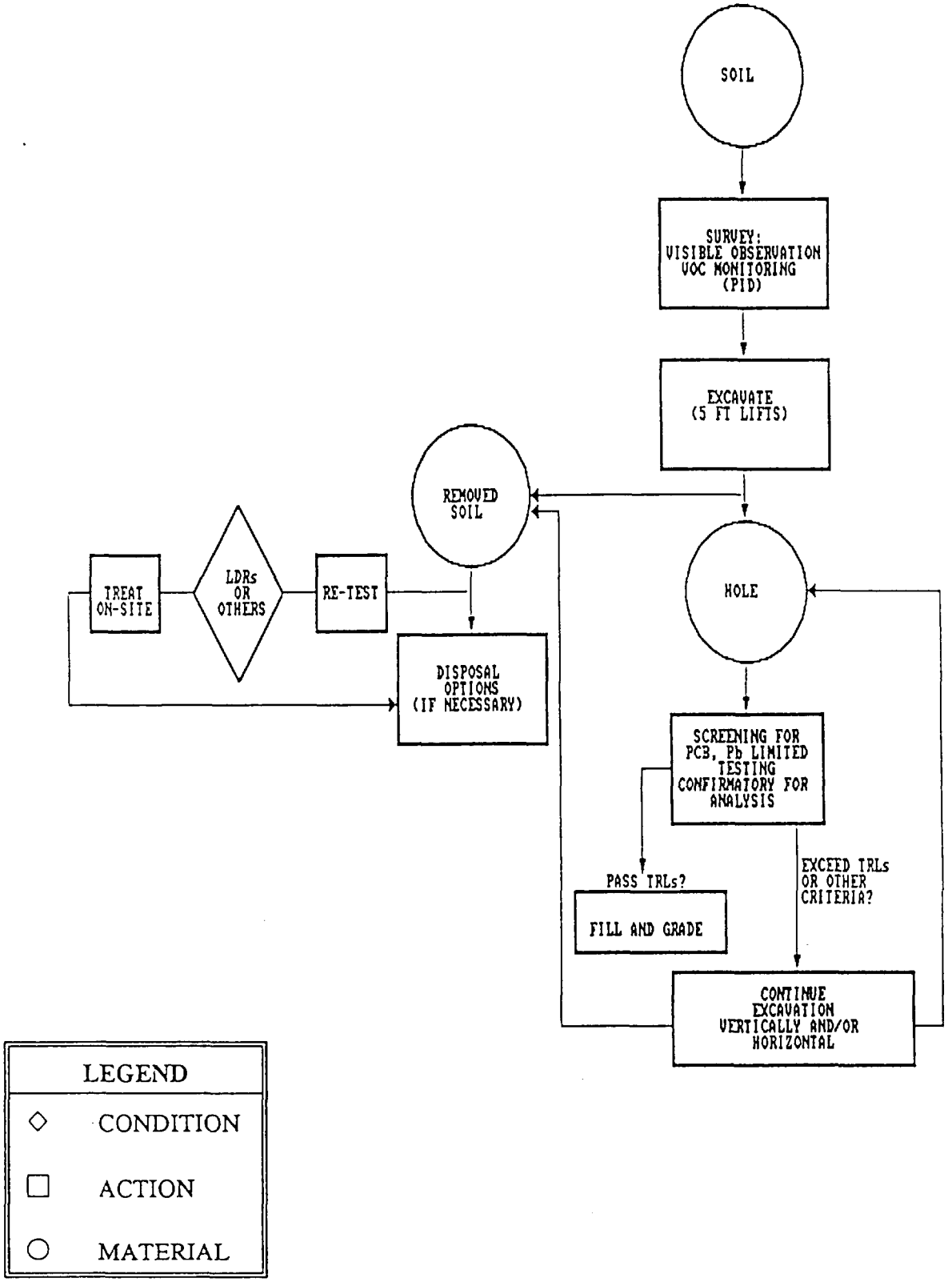


TABLE 3-2
RA/FI PHASE II
ANALYTICAL PROGRAM SUMMARY

Sample Matrix	Number of Sample Locations	Duplicates	Trip Blank	Field Measurements	Sample Location	Analytical Parameters
OWS Area Trench Soils	4 maximum	1 per 10 samples	1 per sample shipment	Total VOC[1]/PCB	Trench	TAL/TCL/ TRPH, PCB/Pb if detected by field screening
Drum Search Trench Soils	28 maximum	1 per 10 max 3	1 per sample shipment	Total VOC[1]	Trenches	TAL/TCL/ TRPH
Exposed Drum Contents	1 per drum	None	1 per sample shipment	Total VOC[1]	Intact Drum Contents	TCLP and as necessary per TSDF disposal criteria
LTD Body Shop Boring	1 maximum	None	1 per sample shipment	Total VOC[1]	Every 5 feet	TAL/TCL/ TRPH
Air Monitoring	Constant during excavation		1 per sample shipment	H&S monitoring[2]	per trench location	Organic Vapors
OWS Trench Liquids	1 per trench if liquid encountered	None	1 per sample shipment	Total VOC[1]	trench liquid collection vessel	TCLP and as necessary per TSDF criteria
Drum Search Trench Liquids	1 per batch	None	1 per sample shipment	Total VOC[1]	trench liquid collection vessel	TCLP and as necessary per TSDF disposal criteria
Decon Water	1 per batch	None	1 per sample shipment		decon liquid collection vessel	TCLP and necessary per TSDF disposal criteria

[1] PID Headspace Reading

[2] Health & Safety PID - Continuous Air Monitoring

3.6 Decontamination

Decontamination procedures will follow the methods discussed in Appendix III of this Work Plan.

3.7 Quality Assurance/Quality Control

All Quality Assurance Quality Control procedures will be in accordance with the approved QAPP and additions to the QAPP as presented in Appendix I. A summary of analytical samples and quality control samples for this task activity to be presented in Table 3-2, Analytical Program Summary.

3.8 Health and Safety Requirements

Health and Safety procedures for all trenching and associated waste handling will be in conformance with the Health and Safety Plan presented in Appendix II of this Work Plan.

4.0 SUBSURFACE DRUM SEARCH TRENCHING/SITE CHARACTERIZATION

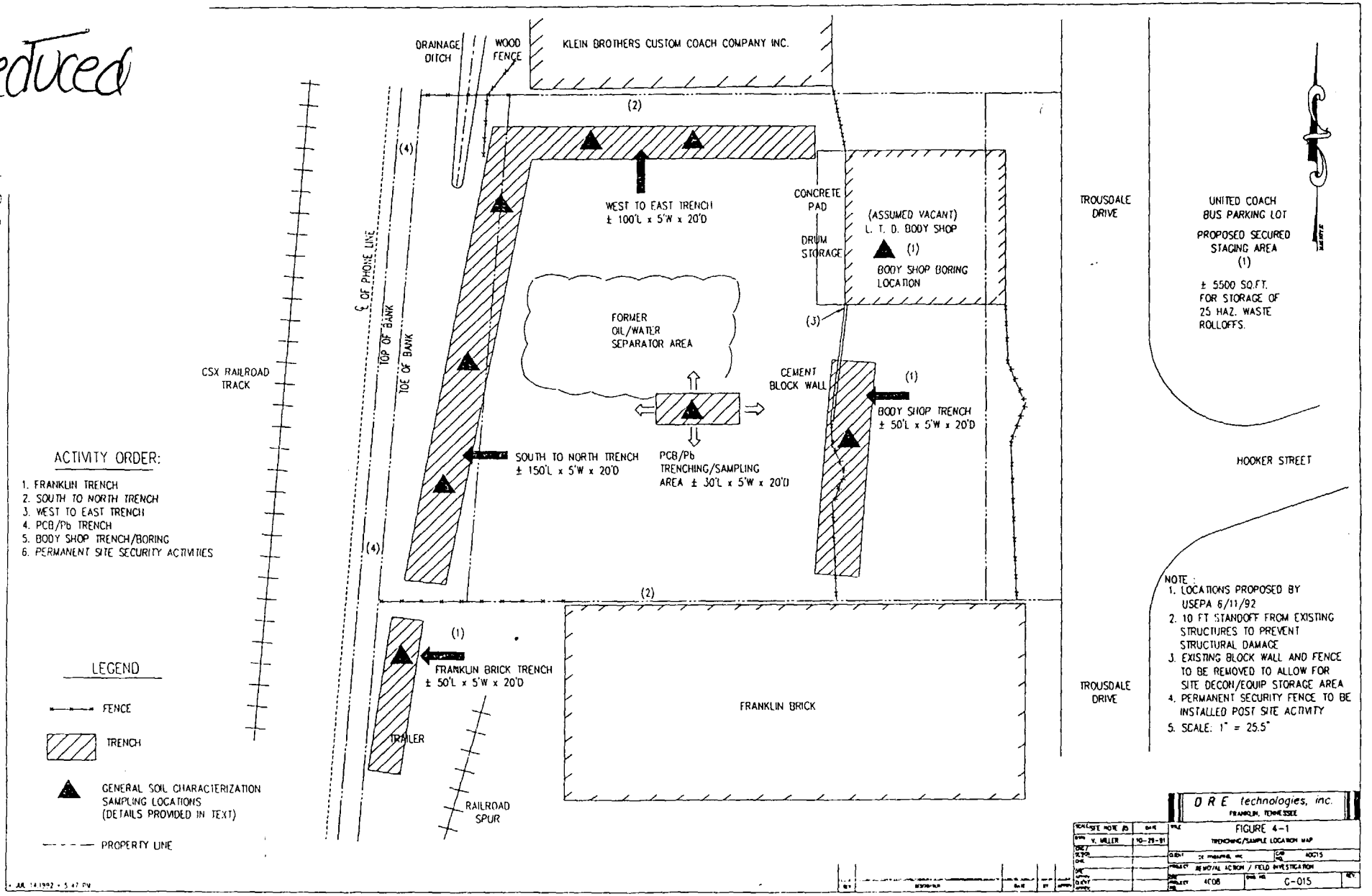
4.1 Previous Data Discussion

During the performance of RA/FI field activities, a total of five drums were encountered in 100 linear feet of trench. These drums were in various stages of deterioration and contained minor quantities of material. The spatial orientation and pattern of these drums did not indicate an organized, large-scale drum disposal operation, however these drums were found to contain hazardous constituents. The AOC requires additional search for drums using the RA/FI Trench Method. These trenching areas are presented in Figure 4-1 Trenching/Sample Location Map.

4.1.1 Objectives

The objective of this task is to perform activities required by the AOC to conduct a drum search and acquire additional analytical data for further site characterization. The additional data will be compiled with existing RA/FI data to reevaluate response alternatives applicable to the site. The objective of the drum search trenching is to locate, remove, sample and dispose of any drums discovered during trenching, and submit samples of excavated soils to an analytical laboratory for TAL/TCL/TRPH analysis for site characterization. Approximately 350 feet of trenching will be performed; fifty (50) feet in the Franklin Brick area, two hundred fifty (250) feet on the west and north sides of the Saad property, and approximately fifty feet in the area of the parking lot and auto storage yard associated with the L.T.D. Body Shop. In addition, shelby tube samples will be obtained for geotechnical analysis to provide on-site evaluation for development of in-situ remedial response alternatives. Trenches will be excavated using trackhoes and backhoes to a maximum depth of 20 feet below ground, which is the approximate depth to the top of bedrock at the site as well as equipment depth limitation. Shelby tube samples will be obtained by pushing tubes with a trackhoe or backhoe.

Reduced


DRAINAGE DITCH
WOOD FENCE
KLEIN BROTHERS CUSTOM COACH COMPANY INC.
(2)
(4)
WEST TO EAST TRENCH
± 100'L x 5'W x 20'D
CONCRETE PAD
DRUM STORAGE
(ASSUMED VACANT)
L. T. D. BODY SHOP
(1)
BODY SHOP BORING LOCATION
(3)
FORMER OIL/WATER SEPARATOR AREA
CSX RAILROAD TRACK
℄ OF PHONE LINE
TOP OF BANK
TOE OF BANK
CEMENT BLOCK WALL
(1)
BODY SHOP TRENCH
± 50'L x 5'W x 20'D
SOUTH TO NORTH TRENCH
± 150'L x 5'W x 20'D
PCB/Pb TRENCHING/SAMPLING AREA ± 30'L x 5'W x 20'D
(4)
(2)
(1)
FRANKLIN BRICK TRENCH
± 50'L x 5'W x 20'D
TRAILER
RAILROAD SPUR
FRANKLIN BRICK
TROUSDALE DRIVE
TROUSDALE DRIVE
UNITED COACH BUS PARKING LOT
PROPOSED SECURED STAGING AREA
(1)
± 5500 SQ.FT. FOR STORAGE OF 25 HAZ. WASTE ROLLOFFS.
HOOKER STREET
ACTIVITY ORDER:
1. FRANKLIN TRENCH
2. SOUTH TO NORTH TRENCH
3. WEST TO EAST TRENCH
4. PCB/Pb TRENCH
5. BODY SHOP TRENCH/BORING
6. PERMANENT SITE SECURITY ACTIVITIES
LEGEND
FENCE
TRENCH
GENERAL SOIL CHARACTERIZATION SAMPLING LOCATIONS (DETAILS PROVIDED IN TEXT)
PROPERTY LINE
NOTE:
1. LOCATIONS PROPOSED BY USEPA 6/11/92
2. 10 FT STANDOFF FROM EXISTING STRUCTURES TO PREVENT STRUCTURAL DAMAGE
3. EXISTING BLOCK WALL AND FENCE TO BE REMOVED TO ALLOW FOR SITE DECON/EQUIP STORAGE AREA
4. PERMANENT SECURITY FENCE TO BE INSTALLED POST SITE ACTIVITY
5. SCALE: 1" = 25.5'
ORE technologies, inc.
FRANKLIN, TENNESSEE
FIGURE 4-1
TRENCHING/SAMPLE LOCATION MAP
REMOVAL ACTION / FIELD INVESTIGATION
4008
G-015

4.2 Requirements and Assumptions

4.2.1 Access Agreements

Prior to conducting the Drum Search/Site Characterization task, access arrangements as necessary will be secured with Franklin Brick, CSX, and Ellis and Kathy Saad as provided for under the provisions of Section VI, paragraphs 16 and 26 of the AOC to allow entry and trenching on that property, and to ensure that prerequisite tasks necessary to conduct operations as discussed below are accomplished.

4.2.2 Storage/Staging

Drums encountered during Drum Search/Site Characterization activities will be removed, sampled, overpacked and stored on-site in a designated area until characterization results are received. Soils and debris excavated will be placed on plastic adjacent to the excavated trench. All drum search trenches will be backfilled with excavated materials. The removal of boulders will be based on field observation with consideration to potential future supplemental activities.

4.2.3 Trenching Limitations

A minimum of ten (10) feet of offset from existing buildings will be required during trenching to minimize the potential for structural damage to adjacent buildings. The trailer on the Franklin Brick property must be relocated by Franklin Brick prior to trench excavation in this area. The same offset is required for the toe of the existing berm located on the western flank of the property to prevent potential bank failure.

Daily trenching activities will be conducted to attempt to close an open trench at the end of the work day. This will minimize the potential hazards associated with open trenches and VOC emissions. In the event that trenches cannot be closed, security barriers will be installed along the perimeter of the trench. All trenches remaining open will be covered with plastic to prevent rainwater from entering an open trench.

Excavation of the trench south of the LTD Body Shop will be conducted after the OWS trench is completed. This sequence is necessitated due to site space limitations, and the fact that heavy

equipment cannot cross over a trenched area due to subsidence problems. In addition, the decontamination pad will have to be removed and reconstructed in another location prior to the excavation of the trench associated with the LTD Body Shop.

4.2.4 Criteria for Drum Bone Removal

During the trench investigation, all drum bones and fragments will be removed and staged. Drum bones (*i.e.*, deteriorated drum shells) will be consolidated and either disposed of as RCRA empty or combined with other debris for bulk disposal. All drum fragments (*i.e.*, lids, rings, etc.) not considered to be drum bones will be managed in a separate manner.

4.3 Drum Search/Site Characterization Procedures

4.3.1 Drum Search/Site Characterization Trenches

This section provides the sequence of trenching operations along with procedures to be employed during this phase of work. The trench locations, and the anticipated sequence, are provided in Figure 4-1, Trenching Map/Sample Locations.

The first trench to be excavated will be the trench located on the Franklin Brick Property. This assumes that the trailer located on the Franklin Brick Property has been removed and the required access agreement with Franklin Brick has been executed. This trench will be a maximum of 50 linear feet (east to west), excavated to a maximum depth of 20 feet, conducted in 5-foot lifts. Based on past trenching activities in this area, there is a possibility that the "concrete pad" could be encountered approximately 10 feet below ground. If the pad is located, no excavation or sampling below the pad will be performed.

The second trench to be excavated will be a south to north excavation along the western side of the Saad property and along the CSX property line. This trench will be approximately 5 feet wide, excavated to a maximum depth of 20 feet below grade. Excavation will be conducted in five-foot lifts. Three shelby tube samples are proposed to be obtained in this area for geotechnical analysis. The geotechnical

samples will be spaced approximately equidistant along the trench length. Specific sample locations will be determined by the project geologist in the field based on site specific conditions.

Upon completion of the south to north trench, a west to east trench will be excavated along the north edge of the Saad property. The third trench will begin at a minimum standoff distance of ten feet south of the Klein Custom Coach building to avoid potential structural damage to the building. The trench dimensions will be approximately 100 linear feet by 5 feet wide and excavated to a maximum depth of twenty feet. Two shelby tube samples will be collected for geotechnical analysis, based on trench conditions and as directed by the project geologist.

The fourth and final trench to be excavated will be a north to south trench directly south of the LTD Body Shop. The trench will be approximately 50 linear feet by 5 feet wide and excavated to a maximum depth of 20 feet, excavated in 5-foot lifts. One shelby tube sample will be collected along this trench to obtain geotechnical data. As detailed in Section 2.0, the current tenant/owner will be required to vacate the premises and remove all debris, auto, auto parts, solvents, etc. prior to mobilization and performance of these activities.

4.3.2 Sampling and Analytical Analysis

Trenches will be excavated in 50 linear foot increments. Two samples will be collected every 10 linear feet in five-foot lifts for field screening and potential TAL/TCL analysis. This sampling protocol will be utilized over the entire trench length. Samples will be jarred and screened using the Photoionization Detector (PID), head space method. The sample with the highest PID reading over the 50 foot linear increment will be sent to the laboratory for TAL/TCL/TRPH analysis. Table 4-1 illustrates an example of the sampling plan for a given 50-foot length trench and 20-foot depth of excavation. A total of 28 samples will be collected based on 350 linear feet of trenching to a depth of 20 feet. Duplicate samples will be required for quality control/quality assurance.

TABLE 4-1

DRUM SEARCH/SITE CHARACTERIZATION
TYPICAL 50 FOOT TRENCH SAMPLING PLAN - EXAMPLE

Linear Feet of Trench East - West

Ft. Below Ground	10	20	30	40	50
0	PID-HS PID-15 ppm	PID-HS PID-10 ppm	PID-HS PID-25 ppm	PID-HS PID - 100 ppm Sample to lab	PID-HS PID-65 ppm
5	PID-HS PID-15 ppm	PID-HS PID-15 ppm	PID-HS PID-1 ppm	PID-HS PID-1 ppm	PID-HS PID-200 ppm Sample to lab
10	PID-HS PID-20 ppm	PID-HS PID-300 ppm Sample to lab	PID-HS PID-1 ppm	PID-HS PID-75 ppm	PID-HS PID-40 ppm
15	PID-HS PID-150 ppm Sample to lab	PID-HS PID-10 ppm	PID-HS PID-15 ppm	PID-HS PID-100 ppm	PID-HS PID-90 ppm
20					

COMMENTS:

PID headspace readings will be taken for all jarred samples over a ten foot by five foot trench excavation lift. Two sets of jarred samples per sample interval.

The sample with the highest PID-HS per five foot lift will be sent to the laboratory for TAL/TCL/TRPH analysis: Note example on table.

PID - HS - Photoionization probe head space method

Total Samples for 350 feet of trench:
28 - TAL/TCL/TRPH
3 duplicates - TAL/TCL/TRPH

The sampling and analysis program for the characterization trenches and the site as a whole is presented in Table 3-2.

Where water in the vadose zone is encountered in sufficient volume to inhibit excavation, it will be pumped to a designated on-site storage vessel. A sample will be collected from the vessel per requirements of the off-site treatment facility for disposal. A total of six (6) shelby tube samples for the 350' trench will be sent to a geotechnical laboratory for geotechnical analysis. Table 4-2 presents specific geotechnical analysis to be performed.

4.3.3 Removal of Drums

All intact drums will be removed from the trenches and overpacked for disposal. A decision tree for drum removal is presented in Figure 4-2. Drums will be placed on plastic adjacent to the trench and overpacked as they are removed from the trench. Drums will be sequentially labeled for tracking and final disposal.

4.3.4 Removal of Liquids, Debris, and Boulders

Water from trenching activities will be pumped to a designated liquid receiving tank. This water will not be commingled with fluids from the OWS activities or decontamination waters unless analytical results indicate compatibility for disposal. Water will be sampled for disposal facility requirements to determine the appropriate disposal method at the end of all site activities. Debris and boulders will be placed on plastic in a designated area during trenching activities. Upon completion of any section of trench, the trench will be backfilled with excavated soils.

The removal of boulders and debris will be based on field observations with consideration to potential future supplemental activities.

4.3.5 Volatile Containment (Piles only)

Volatile Containment will be accomplished using vapor barrier materials or foams, as presented per the OWS Section 3.3.4.

TABLE 4-2

GEOTECHNICAL ANALYSIS

ANALYSIS	PURPOSE
Falling Head Permeability	Fluid movement through soils
Moisture Content	Natural Moisture content in soils
Cation Exchange Capacity	Cation exchange potential of natural soils vs. metals
Total Organic Carbon	Contaminant Mobility
pH	Acid/Base characteristics of soil
Grain Size Hydrometer	Grain size variation
Porosity	Pore space interconnection
Specific Gravity	Density of soil

FIGURE 4-2
DECISION TREE FOR CHARACTERIZATION/CLASSIFICATION OF EXCAVATED DRUMS

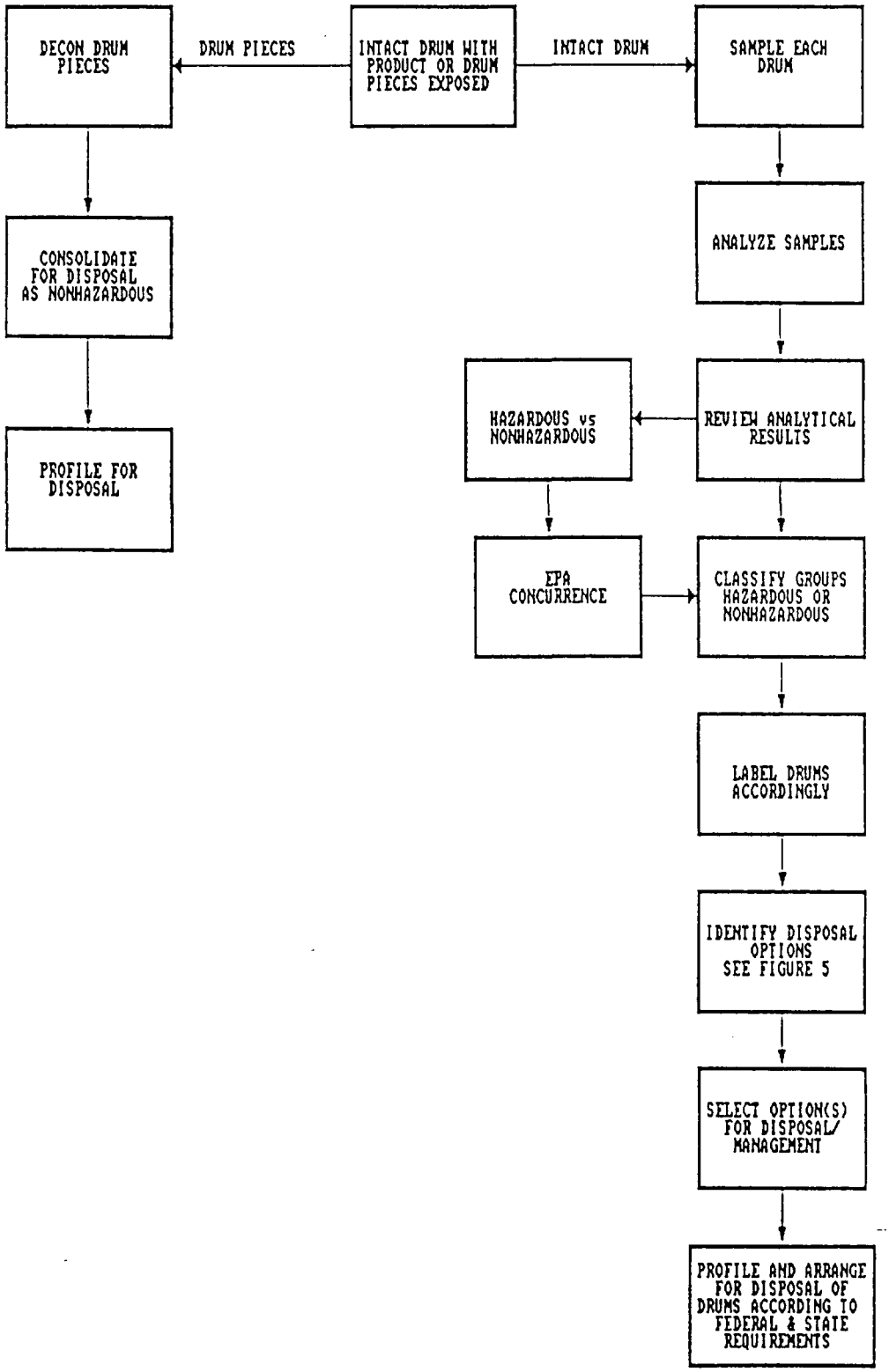
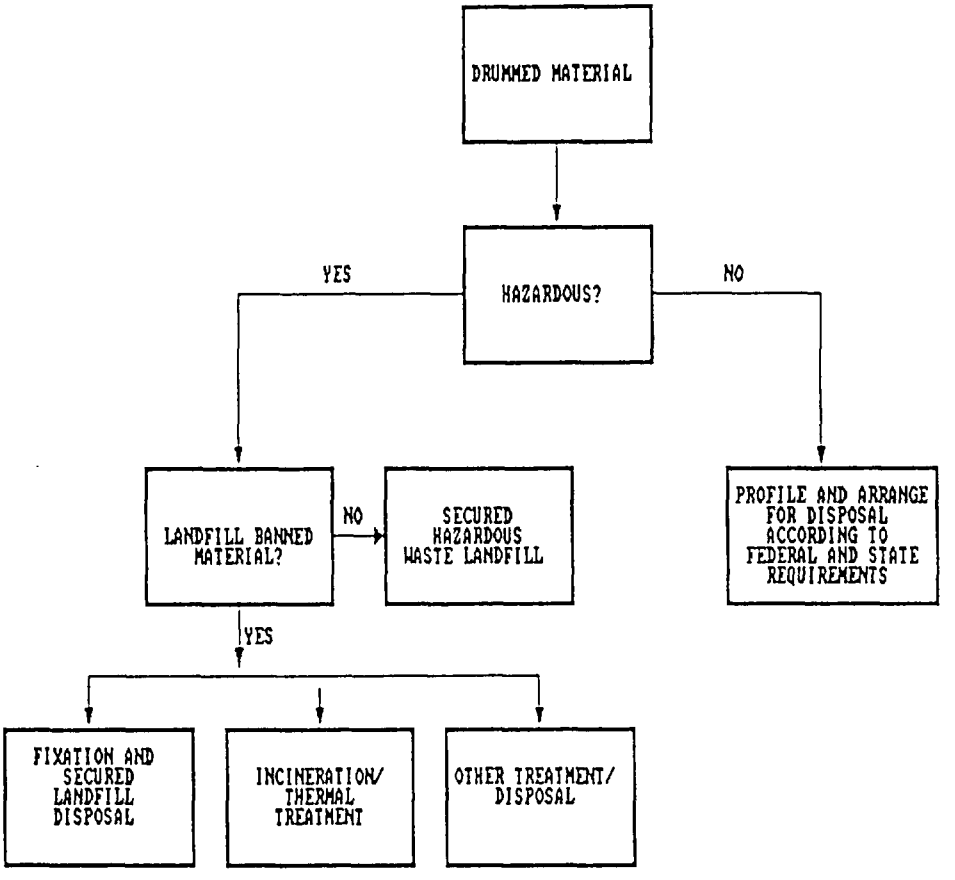


FIGURE 4-2 (Continued)

STEPS FOR CHOOSING A DISPOSAL OPTION



4.3.6 Drum Handling

During all handling of drums or sampling of drummed material, safety equipment and personal protective equipment will be used as described in the Site Safety and Health Plan. Additionally, the handling and movement of drums will be conducted in accordance with requirements set forth by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.120(j).

4.3.7 Soil Staging

Soils will be staged adjacent to the trench and placed on polyethylene. Upon completion on any trench or segment thereof, soils will be placed back in the trench for backfill material.

4.3.8 Installation of Subsurface Galleries

- In conjunction with trenching, the installation of perforated piping with packing material, a gallery, may be installed as part of treatability studies required by AOC. The proposed horizontal trial SVE installation is under consideration; however, the installation of subsurface galleries will not take place if this activity proves to be disruptive to or inconsistent with primary AOC activities. Similarly, the galleries will only be installed if engineering/construction criteria are adequately developed prior to installation.

4.4 Disposal Coordination

4.4.1 Sampling/Analysis

Drums recovered during trenching activities will be sampled for TCLP, or in accordance with disposal facility requirements. Overpacked drums will be appropriately labeled with identification such as sample number and drum number for tracking.

Vadose zone waters, which will be collected during trenching if encountered, will be sampled and analyzed in accordance with required disposal facility requirements.

4.4.2 Procedures

Drums will be stored in overpacks until disposal methods have been chosen based on analytical results and written approvals from the disposal facility and USEPA have been received. Proper chain of custody and manifests will be required for all disposal activities. This documentation will be entered into the permanent project file.

Waters will be pumped into an on-site containment vessel. In accordance with disposal facility requirements, water samples will be obtained and analyzed from the containment vessel to determine the appropriate method of disposal. Proper chain of custody and manifests along with USEPA approval will be required for disposal. All documentation will be entered into the permanent project file.

4.4.3 Approvals

Waste analysis approval for disposal of drums and water will be required by the receiving disposal facility. No disposal activities will be implemented without prior written approval from EPA.

4.5 Decontamination

Decontamination procedures will follow the methods discussed in Appendix IV of this Work Plan.

4.6 Quality Assurance/Quality Control

All Quality Assurance Quality Control (QAPP) procedures will be performed in accordance with the approved QAPP the additions to the QAPP as presented in Appendix I. A summary of analytical samples and QA/QC samples for this task activity are presented in Section 3.7, Table 3-2, Analytical Program Summary.

4.7 Health and Safety Requirements

Health and Safety procedures for all trenching and associated waste handling will be in conformance with the approved Health and Safety Plan (as amended) presented in Appendix II of this Work Plan.

5.0 ANCILLARY FIELD ACTIVITIES

5.1 Subfloor Sampling of LTD Body Shop

The agency has requested that sampling be performed under the existing LTD body shop in the approximate location shown on Figure 4-1. The sample(s) will be obtained by cutting the concrete floor with a concrete saw and performing "drilling" using a portable, gas powered auger (*i.e.*, "Little Beaver") to obtain samples at five-foot (5) intervals to 20 feet or refusal. One additional boring will be attempted in the event of auger refusal at less than five feet of vertical depth. Samples will be screened using a PID and based on PID screening, a single sample (highest PID reading) will be collected for TAL/TCL/TRPH analysis. All soils will be managed in accordance with USEPA guidance regarding site investigative-derived waste and the borehole will be grouted from the bottom of boring to top of ground. The floor will be patched with concrete during demobilization activities.

5.2 Surface Debris Removal

Prior to performing any subsurface activities, all boulders and debris stockpiled on the west side of the site and on CSX property will be removed for off-site disposal. It is anticipated that these materials will be disposed of under the existing nonhazardous waste profile for the BFI Middlepoint Facility. Removal of the surface debris is essential to provide space for performance of site activities.

Any remaining surface debris after the site activities have been completed will be collected, sampled where appropriate, and properly disposed under written manifests. These activities will be conducted during site demobilization.

5.3 Permanent Fencing, Lighting and Signs

Upon completion of all field activities, permanent fencing, ($\pm$200'), to include locks on all gates, security lighting, and appropriate placarding will be installed to address site security.

6.0 Response Alternative Analysis

Appropriate response actions and technologies will be further evaluated at the conclusion of the removal and characterization activities relative to the response action objectives identified in the RA/FI Report. The response alternative analysis will review the development and screening of technology alternatives in the RA/FI Report and incorporate data collected during implementation of this Work Plan. The report will provide a more detailed analysis of retained response action alternatives, evaluate the necessity of treatability studies, and recommend a preferred alternative that is appropriate for the site and its level of risk.

6.1 Data Compilation from Response Activities

Results of all chemical and geotechnical analytical data from the RA/FI Report and the additional characterization data collected during implementation of this Work Plan, will be summarized and presented in a tabular format and illustrated on site activity location maps.

Maps defining subsurface structures and conditions within the soil/vadose zone will be prepared to depict the additional site characterization data. The synthesis of past and current response actions and resulting data will provide the data base which will permit the development and selection of a response action alternative for the site.

6.2 Identification of Potential Response Alternatives

Evaluation of the applicable response alternatives for the site will include the following:

- Refinement of response action objectives
- Evaluation of technical alternatives relative to the initial response goals and TRLs to be established.
- Refinement of response action TRLs based on technical evaluation of alternatives.
- Perform a more detailed analysis of response action alternatives with sufficient information to compare alternatives with respect to the appropriate evaluation criteria.

1.0 Project Description

1.1 Introduction

The Work Plan to which this Quality Assurance Plan (QAPP) is appended has been developed to address conditions at the Saad Trousdale Drive Site (the Site) in Nashville, Tennessee. The purpose of this QAPP is set forth documented procedures that will ensure the accuracy, precision and completeness of the data gathered by the Contractor during the investigatory activities described in this Work Plan. This plan addresses:

- Project staff organization and responsibility.
- The quality assurance (QA) objectives of the project.
- The quality assurance (QA) and quality control (QC) procedures that will be implemented in order to achieve the desired level of data quality.

The objectives of the QAPP are to ensure that the procedures used during on-site activities will not detract from the quality of the results and to ensure that all activities and subsequent findings and results adhere to the guidelines set forth in this QAPP.

1.2 Elements of the Work Plan

The major field elements of the Work Plan include provisions for the following exploratory and removal activities:

- Extent of PB/Pb Contamination in soils adjacent to the Oil Water Separator Excavation
- Drum Search and Soils Characterization

The Work Plan elements have been designed for the performance of removal actions and investigatory activities that will comply with the Administrative Order by Consent dated August 12, 1992 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sections 104, 106(a) and 122.

- Recommendation of a preferred response action alternative (if warranted).

6.3 Treatability Study Evaluation

The results of physical and chemical observations (soil/subsurface characterization and analytical results) will be utilized to develop further recommendations regarding treatability options including cost, applicability, and limitations. The subsurface galleries, if installed in the trench areas, will be utilized to develop preliminary information on the overall application of soil vapor extraction with biological enhancement and the potential of other subsurface recovery technologies.

6.4 Supplemental Activities

If during the course of the implementation of this Work Plan additional data needs or activities are identified, these activities will be performed prior to submittal of the final report. EPA will be provided notice, and appropriate supplemental plans, for approval will be submitted to the EPA for review within 30 days of the identified supplemental data or work requirements.

To ensure flexibility for decision making should unforeseen circumstances arise, the Project Coordinator shall have the authority to make on-site, field decisions on behalf of the Respondents as provided for in the AOC.

6.5 Report

At the conclusion of the removal action and any supplemental activities, a Removal Action Report will be prepared and submitted to the USEPA. The report will document all removal and site characterization activities, contain a section on (including data compilation from the RA/FI Phase I work) response action alternative analysis, and contain conclusions and recommendations.

7.0 Schedule

The performance schedule for the Removal Action/Field Investigation Phase II Work Plan is presented on Figure 7-1. Project activities are to be initiated within seven (7) days of written approval by EPA of this Work Plan, execution of all required access agreements, and performance of all prerequisite tasks by others as identified in this Work Plan. Anticipated site mobilization and site preparation by others is to be initiated by July 29, 1992 assuming approval by July 22, 1992. Work Plan implementation is estimated to require a minimum of 43 days, but may be extended by contingencies as identified on the schedule. The schedule begins upon written authorization from EPA, obtaining all required access agreements and vacating (including removal of debris) of the LTD Body Shop.

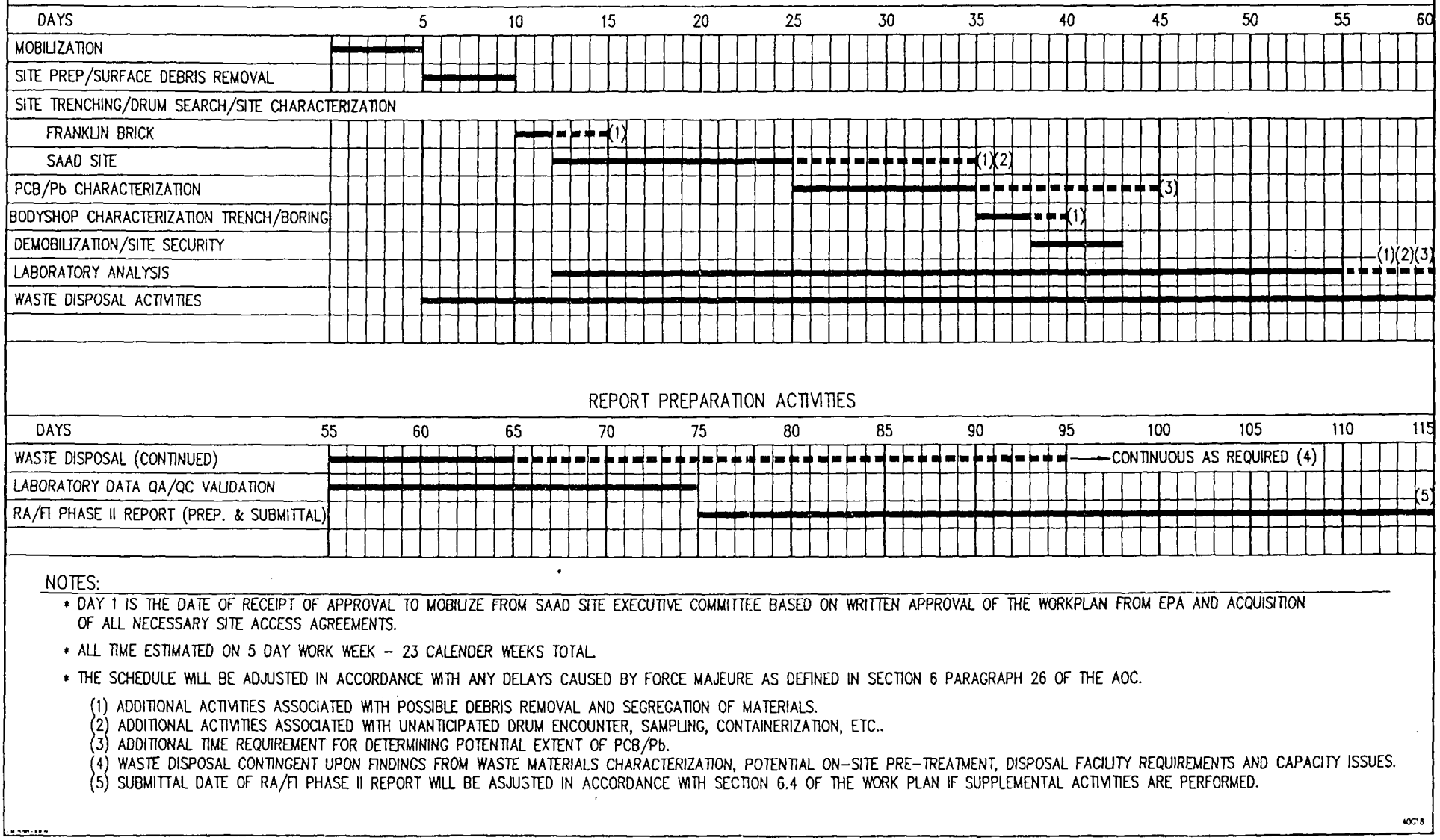
The schedule will be adjusted in accordance with any delays caused by force majeure as defined in Section 6 Paragraph 26 of the AOC. Report preparation will be initiated after receipt of all analytical data and after appropriate internal QC validation requirements.

7.1 Sequence of Activity

Project activities are to be performed in the following sequence:

1. Site Mobilization/Site Preparation (including restricting access)/Surface Debris Removal
2. Site Trenching - Drum Search/Site Characterization
3. PCB/Pb Characterization
4. Body Shop Trenching/Borehole for site characterization
5. Site Demobilization/Site Security
6. Removal Action Phase II Report

FIGURE 7.1 SCHEDULE OF SAAD SITE REMOVAL ACTION/FIELD INVESTIGATION PHASE II WORKPLAN TASKS



NOTES:

- DAY 1 IS THE DATE OF RECEIPT OF APPROVAL TO MOBILIZE FROM SAAD SITE EXECUTIVE COMMITTEE BASED ON WRITTEN APPROVAL OF THE WORKPLAN FROM EPA AND ACQUISITION OF ALL NECESSARY SITE ACCESS AGREEMENTS.
- ALL TIME ESTIMATED ON 5 DAY WORK WEEK – 23 CALENDER WEEKS TOTAL.
- THE SCHEDULE WILL BE ADJUSTED IN ACCORDANCE WITH ANY DELAYS CAUSED BY FORCE MAJEURE AS DEFINED IN SECTION 6 PARAGRAPH 26 OF THE AOC.

(1) ADDITIONAL ACTIVITIES ASSOCIATED WITH POSSIBLE DEBRIS REMOVAL AND SEGREGATION OF MATERIALS.
(2) ADDITIONAL ACTIVITIES ASSOCIATED WITH UNANTICIPATED DRUM ENCOUNTER, SAMPLING, CONTAINERIZATION, ETC..
(3) ADDITIONAL TIME REQUIREMENT FOR DETERMINING POTENTIAL EXTENT OF PCB/Pb.
(4) WASTE DISPOSAL CONTINGENT UPON FINDINGS FROM WASTE MATERIALS CHARACTERIZATION, POTENTIAL ON-SITE PRE-TREATMENT, DISPOSAL FACILITY REQUIREMENTS AND CAPACITY ISSUES.
(5) SUBMITTAL DATE OF RA/FI PHASE II REPORT WILL BE ASJUSTED IN ACCORDANCE WITH SECTION 6.4 OF THE WORK PLAN IF SUPPLEMENTAL ACTIVITIES ARE PERFORMED.

40C18

Reduced

QUALITY ASSURANCE PROJECT PLAN
FOR
REMOVAL ACTION/FIELD INVESTIGATION
AT THE
SAAD TROUSDALE DRIVE SITE

3655 TROUSDALE DRIVE
NASHVILLE, TENNESSEE

JUNE 1992

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

1.3 Site Description

The Site is an approximately one-half acre parcel of property located at 3655 Trousdale Drive in Nashville, Tennessee. During the 1970's and early 1980's, this site was occupied by an oil recycling business. The Site is currently occupied by an automotive body shop.

1.4 Project Objectives

The objective of the on-site activities described in this Work Plan, as mentioned previously, is compliance with the requirements of the Order. More specifically, the objectives of this project are to:

- Gain information necessary to determine the nature and extent of any on-site soil contamination;
- Gain additional information necessary for evaluation of potential remedial alternatives.
- Provide for the greatest margin of personnel safety during the performance of all on-site activities.

The ultimate goal of all on-site activities is the eventual elimination or reduction of any hazard to the human health or the environment posed by the Site to a level determined to be accepted by the Environmental Protection Agency.

1.5 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support EPA decisions during removal and/or remedial activities DQOs must be considered when planning any study.

The DQO chosen for a given project will be dependent upon the intended use of the data. Since this investigation is being conducted pursuant to a removal action under CERCLA 106, DQO Level IV quality data are unnecessary. DQO Level V procedures for decontamination and sampling will be utilized at the Site.

DQO Level V procedures are by definition non-standard and are not discussed in detail in EPA guidance documents. The field procedures proposed for implementation at this site are included in Sections 3.0, 4.0, and 5.0 of the Work Plan.

2.0 Project Organization and Responsibilities

2.1 Project Organization

de maximis, inc. will serve as Project Coordinator. DRE Geological Services, Inc. is the Project Manager and responsible for all Site-related activities including quality control of all on-site operations. Contractor personnel will conduct the required sampling, monitoring and documentation of on-site activities. The Contractor will also be responsible for trenching and other heavy equipment operations. Figure 1 depicts the Project Team organization.

2.2 Project Responsibilities

For technical activities associated with this site, project organization is composed of the following personnel with the responsibilities indicated as follows:

- The Project Coordinator (PC) will serve as the primary contact point for the EPA On-Scene Coordinator and the PRP group. The PC will also be responsible for general oversight of all technical activities, on-site or otherwise, relating to this project.
- The Project Manager (PM) will be responsible for general management of all technical project activities including those activities related to scheduling, budgeting, contract management as well as providing oversight for all on-site field operations.
- The Site Manager (SM) will be responsible for implementation of the Work Plan and management of on-site field operations. The Site Manager will also serve as the Safety Officer for this project and thus will be responsible for implementation of the Site Safety Plan included as Appendix I of the Work Plan.

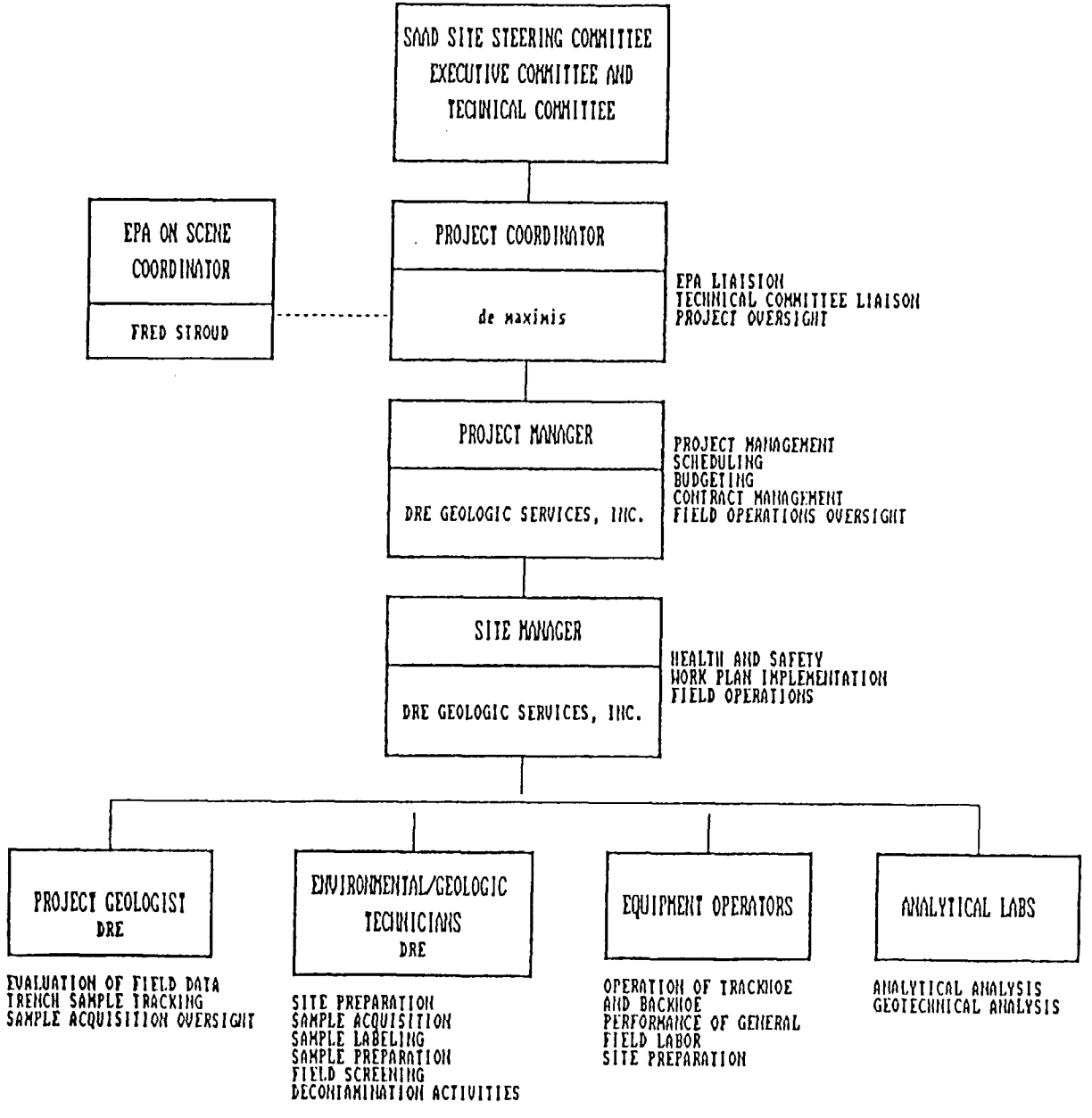


FIGURE 1

PROJECT TEAM FOR THE REMOVAL ACTION/FIELD INVESTIGATION - PHASE II
SAAD SITE, TROUSDALE DRIVE, NASHVILLE, TENNESSEE

- The Field Geologist will be responsible for directing all trenching and boring activities, evaluating all field data obtained during on-site activities, and for the oversight of all acquisition of soil samples.
- Technician(s) will be responsible for various field activities including but not limited to actual acquisition of soil samples, labeling of samples, and carrying out required decontamination activities.
- Equipment Operator(s) will be responsible for the operation of such equipment as trackhoes, or backhoes and will be responsible for general field labor as necessary.
- The Laboratory will provide sample containers and will be responsible for ensuring that samples acquired during on-site activities are received, documented and the results submitted to the Contractor in accordance with all required procedures. The Laboratory will also be responsible for all necessary QA surveillance and audit functions in accordance with US EPA Contract Laboratory Program (CLP) protocols to assure that the laboratory phase of this project is conducted in accordance with the terms and conditions of this QAPP.

3.0 Quality Assurance (QA) Objectives for Data Measurement

The quality assurance objective for data measurement is to ensure that environmental monitoring data of a known and acceptable quality are obtained. The quality objectives for Site analytical data are to ensure that:

- The data generated will be scientifically valid.
- The data generated will be sufficient quality to withstand legal scrutiny.
- The data will be gathered and/or developed in accordance with procedures appropriate for the intended use of the data.
- The data generated will be known and acceptable completeness, representatives, comparability, quantitation limits, precision and accuracy.

Data from laboratory analysis of soil samples taken from the Site will be used to characterize conditions at the Site and to aid selecting options for any subsequent remediation of the Site.

Analyses of samples taken during the on-site activities described in this Work Plan will be analyzed for the compounds included on the US EPA Contract Laboratory Program Target Compound List/Target Analyte List (CLP TCL/TAL). A list of these compounds is included as Attachment A.

All procedures detailed in the attached Specialized Assays Quality Assurance Manual (included as Appendix III) will be adhered to by the laboratory during this project unless these are in direct conflict with CLP protocols; if this is found to be the case, CLP protocols will be followed and will take precedence over all other laboratory standard operating procedures (SOPs) and QA/QC methodology.

3.1 Completeness

Completeness is the percent of measurements made which are judged to be valid. The completeness of the data reflects that all the required samples have been taken and the appropriate analyses have been performed so that an adequate body of data is generated to successfully complete the objectives of the project as defined in the Work Plan. The CLP requirements for data completeness along with those for precision and accuracy are included in Appendix III.

3.2 Representative

Representativeness is the degree to which the sample data accurately and precisely represent an environmental condition. Representativeness is achieved by making certain that sampling locations are selected properly and a sufficient number of samples are collected. Representativeness will be addressed by describing the rationale for sampling points and analytical parameters in the sampling sections (Section 3.4.3, 4.3.2, and 5.1) of the Work Plan.

3.3 Comparability

Comparability is indicative of the confidence with which one data set can be compared with another. The Work Plan will specify that the sampling methods employed, the chain-of-custody methods through which the samples are transferred to the analytical laboratory and the analytical methodology employed by the laboratory be performed in a uniform manner.

3.4 Quantitation limits

The quantitation limit for a given parameter is defined by the EPA Contract Laboratory Program (CLP) protocol. The contract analytical laboratory performing analyses taken during on-site activities will adhere to the protocols set forth in the most recent CLP protocol available. A list of the TCL/TAL compounds and their respective method detection limits is included as Tables 5-1 through 5-6 of Appendix III.

3.5 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Precision will be expressed in the following statistical terms: standard deviation, relative standard deviation, and range or relative range. The contract laboratory objective for precision will be to meet or exceed the level of precision demonstrated for similar samples and will be within the established EPA control m\limits for the method(s) employed.

4.0 Sampling Procedures

This Work Plan includes provisions for the acquisition of a variety of media. While most sampling conducted during this project will be directly related to the characterization of on-site soils, some sampling of other media will be necessary in support of waste characterization and disposal efforts.

A number of sample types may be collected including liquids, solids, sludges or vapors from various drums, containers, boreholes, or trenches. The acquisition of surface soil, sediment or rock samples may also be necessary. Generally, sampling procedures will be based upon acceptable EPA practices.

4.1 Drum Sampling

Drums encountered during excavation activities containing product will be sampled Product samples will be submitted for TCLP laboratory analysis. Drums containing product will be overpacked following sampling for proper disposal.

4.2 Trenching

Trenching will be performed to carefully remove sections of soil during subsurface soil studies. This method of sampling entails the excavation of a trench into the subsurface of the soil and the acquisition of samples from either soil in the bucket.

4.3 Subsurface Soil or Rock

Soil samples designated for physical (permeability, Atterberg Limits) analysis will be collected by using thin walled samplers.

4.4 Blanks and Duplicates/Splits

The following blank and duplicate and/or split samples will be collected and analyzed as specified in the general operations sections (Section 3,4, and 5) of the Work Plan.

4.4.1 Trip Blanks

The purpose of a trip blank is to determine whether contaminants may have been introduced during sample shipment. Trip blanks are analyzed for purgeable compounds only and are consist of sample bottles filled in the laboratory with organic-free water and sent to the sampling locations along with sampling lifts. The unopened trip blanks are then returned to the laboratory, along with the samples acquired during the sampling event, and analyzed.

4.4.2 Field Blanks

The purpose of field blanks is to determine whether possible contamination of samples has occurred through the sampling equipment. There are two basic types of field blank samples: ambient-condition blanks and equipment blanks.

Ambient-condition blanks are collected by carrying empty sample bottles into the field and filling these with an approved water on-site. These samples are then preserved

and handled in the same manner as the environmental samples. Analysis of these samples is performed to determine whether airborne contamination was introduced during sample collection.

Equipment blanks consist of samples collected from final rinsate water generated during decontamination of field sampling equipment. These samples are then preserved, handled and analyzed to determine whether contamination may have been introduced due to the improper decontamination of sampling equipment.

4.4.3 Duplicates

Sample duplicates are collected to assure the precision of the sampling and analytical processes. Each duplicate will be labeled with a sample number but not identified as a duplicate. Duplicate samples are collected by mixing a quantity of sample water or soil (to be analyzed for non-volatile parameters) and collecting a sample and a duplicate from the mix. Care must be taken to document duplicate sample numbers in the field notes. Analysis of duplicate samples is then performed at the analytical laboratory and the results reviewed to detect discrepancies in the resultant data.

4.4.4 Split Samples

The purpose for and process of collecting split samples are essentially the same as those of duplicate samples as discussed above. The difference between the two being that split samples are transported to separate analytical laboratories for analysis as opposed to one lab in the case duplicate samples.

5.0 Sample Custody Procedures

In order for sample analytical data to be defensible, the integrity and identity of samples must be well maintained and documented. The history of each sample and handling of each sample must be documented through all transfers of custody until it is received at the analytical laboratory. Internal laboratory records then documented the custody of the sample through its final disposition. A sample is considered to be in someone's custody if:

- It is in one's actual physical possession;
- It is in one's view, after being in one's physical possession;

- It is in one's physical possession and then locked or otherwise sealed so that tampering would be evident; or
- It is kept in a secure area, restricted to authorized personnel only.

To summarize, the possession of samples will be traceable from the time they are obtained until they are introduced as evidence in support of a decision or as evidence in legal proceedings.

5.1 Sample Identification

All samples will be identified by a sample label affixed to each sample or container. The sample label will include the following information:

- Sample identification
- Date and time of collection
- Initials of sample collector
- Sample site
- Sample type

All sample labels will be completed using black, waterproof ink. Each sample will be designated with a unique alphanumeric code which will identify the sample. After collection, each sample will be maintained under chain-of-custody procedures until it is in the custody of the laboratory. Additionally a tamperproof seal will be affixed to each sample container upon the placement of sample material in the container.

If a sample is to be split, it will be apportioned into similar sample containers and the labels for each of these containers will contain identical information except that one of the labels will be marked "Split". Similarly, labels will be marked for "Blank" or "Duplicate" samples.

If an error is made during the recording of information, the error may be corrected by lining through the error, entering the correct information, and initialing and dating the correction.

5.2 Field Chain-of-Custody Procedures

The Site Manager is responsible for the care and custody of the samples collected until they are properly accepted by the analytical laboratory. A chain-of-custody form will include the following information (also included on the individual sample labels) regarding each sample shipped to the laboratory:

- Sample identification
- Sample type
- Data and time of collection
- Initials of sample collector
- Sample site
- Signatures of persons involved in chain of possession
- Inclusive dates and times of possession
- Analyses requested
- Date and time of receipt by the analytical laboratory

Any time possession of a sample changes, the date, time and name of the person taking possession of the sample must be included on the chain-of-custody form. After the samples are accepted by the laboratory, the completed chain-of-custody form will be returned to the Project Manager for inclusion in the project file. Additionally, information regarding the sampling documentation procedure will be recorded in a bound field logbook kept by the Site Manager.

5.3 Laboratory Chain of Custody Procedures

All contract laboratory chain-of-custody procedures are described in the attached quality assurance manual provided by Specialized Assays and will be followed unless any of the provisions of the standard procedures are direct conflict with the CLP protocols; in which case the standard procedures are in direct conflict with the CLP protocols; in which case the CLP protocols will take precedence.

5.4 Final Evidence Files

All documents generated by the laboratory relating to samples such as tags, data sheets, chain-of-custody and laboratory records shall be directed to the Project Manager for inclusion in the project file along with the chain-of-custody information and other related project documents.

6.0 Field Analytical/Detection Equipment

The Site Manager (SM) will be responsible for assuring that all field instruments are calibrated as indicated in this section. The SM will also be responsible for maintaining a master calibration file for each measuring and testing device which includes, at a minimum, the following information:

- Name of device
- Device serial and/or identification number
- Frequency of calibration
- Date of last calibration
- Name or party performing last calibration
- Due date for nest calibration

Following are the field instruments that will be used at the site along with instructions for frequency and methods of calibration.

6.1 PhotoVac MicroTip Photoionization Detector (PID)

The PID organic vapor detector will be maintained and field calibrated daily using an analyzed gas mixture of 100 ppm isobutylene and is provided in a pressurized container, in accordance with the manufacturer's instructions. The battery on this instrument will be checked at 2-hour intervals during periods of continuous use. Standard operating procedures are provided in Appendix V.

6.2 Analytical Laboratory Functions

The combustible gas/oxygen meter used at the site will be maintained and calibrated daily or prior to each use in accordance with a manufacturer's instructions. The combustible gas indicator function will be calibrated through the use of a cylinder of compressed gas of known concentration and lower explosive limit (LEL) value. The oxygen meter function will be calibrated in a normal atmosphere to 21%. The battery powering this device will be checked ar 2-hour intervals during periods of continuous use.

6.3 Rapid PCB Soil Field Screening Test Immunoassay System

The Ensys, Inc. rapid immunoassay system PCB soil field screening test will be used to provide rapid on site analysis of soil samples for PCBs. The specific manufacturers operating instructions will be followed to insure accurate screening results. Manufacturer standards will be used to calibrate the photometer used to determine test results. The tests will be performed in a controlled environment i.e., inside the site command facility to insure constant test conditions. Manufacturer's operating instructions are provided in Appendix V.

7.0 Analytical Laboratory Functions

All laboratory functions including but not limited to calibration, internal quality control, systems audits, preventative maintenance of lab instrumentation, data assessment procedures, and corrective action are addressed in detail in the attached Specialized Assays Quality Assurance Manual (Appendix III).

ATTACHMENT A

CONTRACT LABORATORY PROGRAM
TARGET COMPOUND LIST/TARGET ANALYTE LIST

Volatile Organic Compounds

Chloromethane
Bromomethane
Vinyl chloride
Chloroethane
Methylene chloride

Acetone
Carbon disulfide
1,1-Dichloroethene
1,1-Dichloroethane
trans-1,2-Dichloroethene

Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Tetrachloroethane
Carbon tetrachloride

Vinyl acetate
Bromodichloroethane
1,2,2,2-Tetrachloroethane
1,2-Dichloropropane

Trichloroethane
Dibromochloroethane
1,1,2-Trichloroethane
Benzene
cis-1,3-Dichlorpropene

2-Chloroethyl vinyl ether
Bromoform
2-Hexanone
4-Methyl-2-pentanone
Tetrachloroethene

Toluene
Chlorobenzene
Ethylbenzene
Styrene
Xylenes (total)

Base/Neutral and Acid Extractables

Phenol
bis(2-Choloethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene

Benzyl alcohol
1,2-Dichlorobenzene
2-Methylphenol
bis(2-Chlorosopropyl) ether
4-Methylphenol

n-Nitroso-dipropylamine
Hazachloroethane
Nitrobenzene
Isophorone

Dimethylphthalate
Acenaphthylene
3-nitroaniline
Acenaphthene
2,4-Dinitrophenol

4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Diethylphthalate

4-Chlorophenyl phenyl ether
Fluorene
4-Nitroaniline
4,6-Dinitrotoluene

TARGET COMPOUND LIST/TARGET ANALYTE LIST, continued

Base/Neutral and Acid Extractables, (continued)

2-Nitrophenol

1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hezachlorobutadiene
4-Chloro-3-methylphenol
2-Methylnaphthalene

Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Nitroaniline

n-Nitroso-diphenylamine

Anthracene
Di-n-butylphthalate
Flouranthene
Pyrene
Butyl benzyl phthalate
3,3-Dichlorobenzidine

Benzo(a)anthracene
bis(2-Ethylhexyl)phthalate
Chrysene
Benzo(b)fluoranthene

Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene

Pesticides/PCBs

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)

Aldrin
Heptachlor epoxide
Endosulfan I
Dieldrin
4,4-DDE

Endrin
Endosulfan II
4,4-DDD
Endosulfan Sulfate
4,4-DDT

Endrin ketone
Methodychlor
Chlordne
Toxpahene
Heptachlor

Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

Metals and Cyanide

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

APPENDIX II

APPENDIX II

REVISED
HEALTH AND SAFETY PLAN
FOR
REMOVAL ACTIONS/FIELD INVESTIGATION - PHASE II
AT THE
SAAD TROUSDALE DRIVE SITE

3655 TROUSDALE DRIVE
NASHVILLE, TENNESSEE

July 1991/July 1992

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

I. INTRODUCTION

This plan has been developed to provide a written health and safety program for activities associated with the site removal and characterization activities for the Saad Trousdale Drive Site (hereinafter referred to as "the Site") in Nashville, Tennessee. An area map of the Site is included as Figure 1 of this plan site specific schematic is included as Figure 2.

This Health and Safety Plan details specific responsibilities, training requirements, protective equipment, operating procedures, emergency procedures, and medical monitoring requirements associated with site activities. This plan also describes the health and safety guidelines which have been developed to protect personnel on-site (site workers, inspectors, and approved visitors). These guidelines are based on information available prior to beginning on-site work and are subject to change should monitoring indicate the need for change. Changes to the site safety plan will be documented with the appropriate justification per the Site Safety Log (Attachment A).

II. HEALTH AND SAFETY CONSIDERATIONS

A. Personnel Awareness

Site workers, inspectors and approved visitors will be apprised of the nature of the work being done and the nature of existing and potential hazards prior to Site entry. The complete Health and Safety Plan will be discussed and reviewed with all site personnel prior to initiating work and will be made available for individual review through the Site Managers. A list of all compounds detected during the most recent investigation of the Site is included in Attachment B along with a description of each. A list of safety-related equipment which will be available on-site is included in Attachment C.

The medical facility located nearest the Site is Southern Hills Medical Center at 391 Wallace Road. The location of this facility is indicated on Figure 1 of this report.

All personnel entering the Site will acknowledge having received this information by signing the Worker Certification (Attachment D).

B. Training

All personnel who are assigned work duties at the Site will certify that they have met the OSHA requirements through experience or specific training as required by 29 CFR

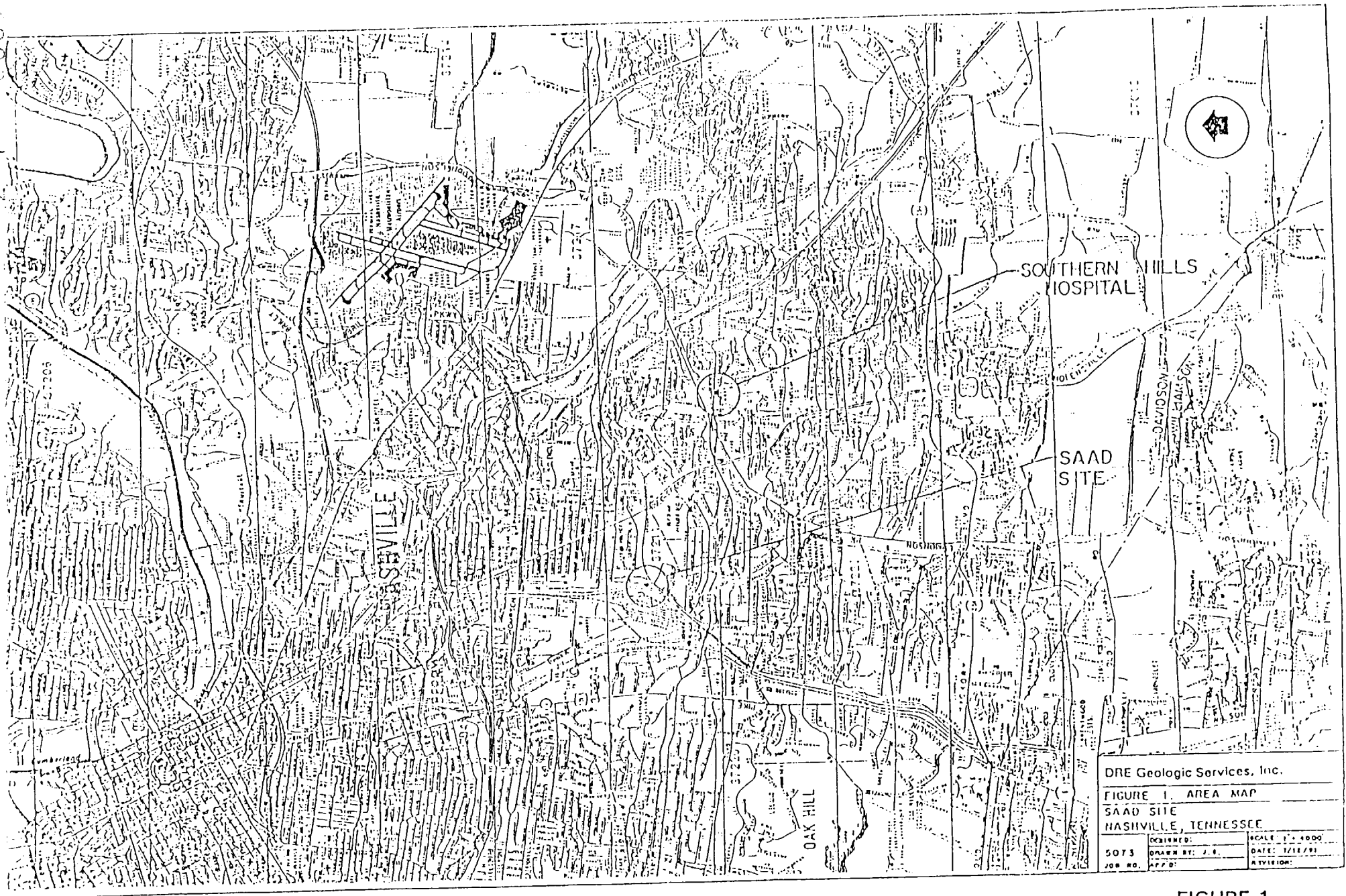

SOUTHERN HILLS
HOSPITAL
SAAD
SITE
OAK HILL
DRE Geologic Services, Inc.
FIGURE 1. AREA MAP
SAAD SITE
NASHVILLE, TENNESSEE
5073
JOB NO.
SCALE: 1" = 4000'
DATE: 7/15/93

FIGURE 1

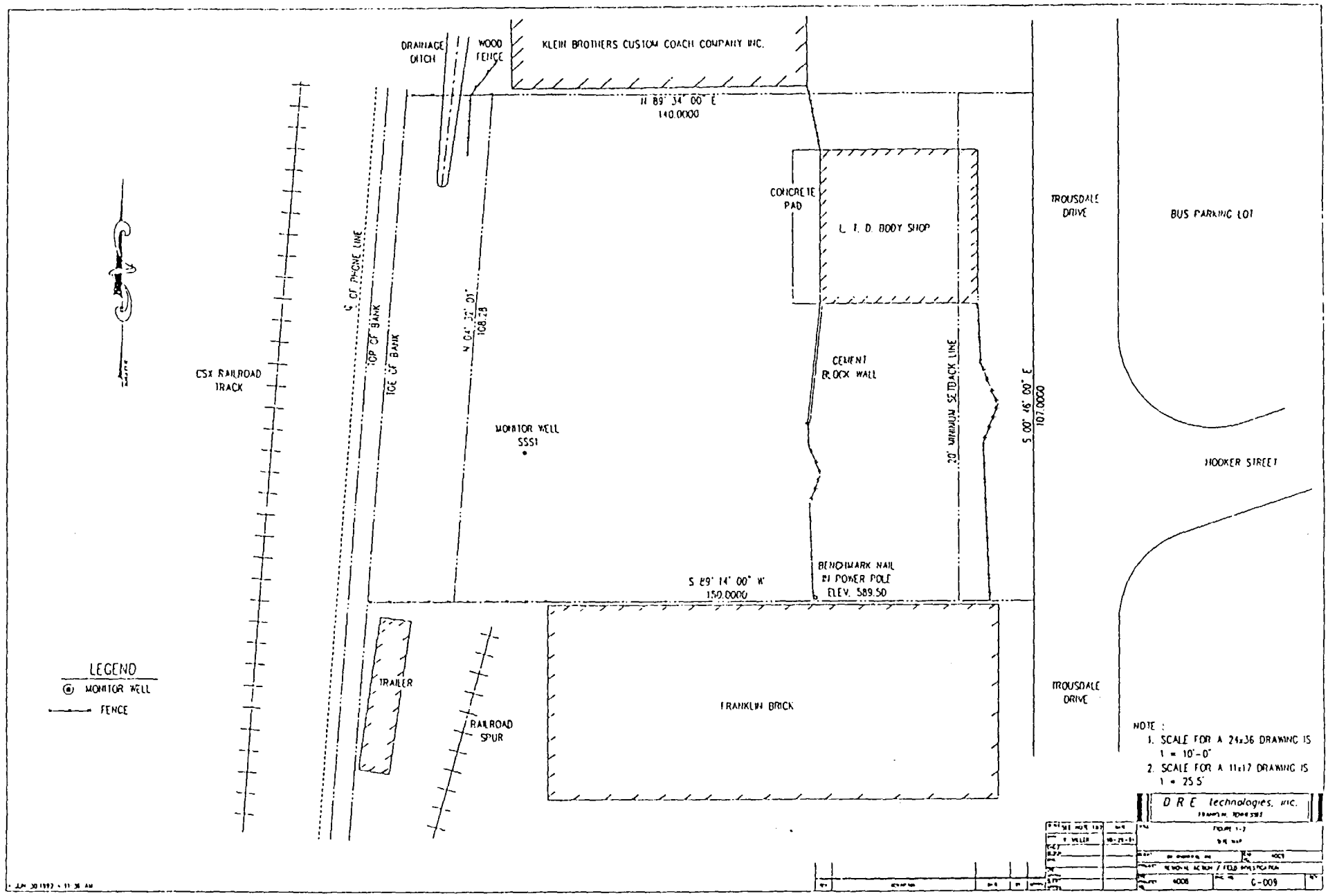

KLEIN BROTHERS CUSTOM COACH COMPANY INC.
DRAINAGE DITCH
WOOD FENCE
N 89° 34' 00" E
140.0000
CONCRETE PAD
L. I. D. BODY SHOP
TROUSDALE DRIVE
BUS PARKING LOT
HOOKER STREET
CSX RAILROAD TRACK
℄ OF PHONE LINE
TOP OF BANK
TOE OF BANK
N 04° 32' 01" E
108.28
MONITOR WELL SS51
CEMENT BLOCK WALL
20' MINIMUM SETBACK LINE
S 00° 46' 00" E
107.0000
BENCHMARK NAIL IN POWER POLE ELEV. 589.50
S 89° 14' 00" W
150.0000
TRAILER
RAILROAD SPUR
FRANKLIN BRICK
TROUSDALE DRIVE
LEGEND
MONITOR WELL
FENCE
NOTE :
1. SCALE FOR A 24x36 DRAWING IS 1 = 10'-0"
2. SCALE FOR A 11x17 DRAWING IS 1 = 25'5"
D R E Technologies, Inc.
4008
C-009

FIGURE 2

1910.120. This certification requirement is noted on the "Worker Certification Page" included as Attachment D of this plan. Personnel who do not meet the requirements of the regulations or are unwilling to sign the certification will not be allowed entry to the Site. Visitors or other personnel will not be allowed in the work-zone unless they have received the required OSHA training, are dressed in the appropriate PPE, and will be required to comply with all decontamination procedures.

C. Safety Officer

The Project Manager, or designated individual(s), will serve as the Safety Officer for the project and will be identified by name in the Safety Log. The Safety Officer will be responsible for implementation of the safety program described in this plan. The duties of this position include: maintaining the Safety log; supervising or carrying out atmospheric monitoring; safety briefings of all workers and visitors; determining the level of PPE that is required; controlling entry and exit access to the Site; monitoring workers before and during work to ensure their suitability for performing their assigned tasks; and observation of all on-site activity to ensure the safety plan is being adhered to and identification of potentially unsafe situations.

D. Safety Meetings

A morning briefing will be held at the beginning of each work day to reiterate safety practices, designate the necessary protective equipment needed for the day's activities, and review the work planned for the day.

E. Communications

The Site is a small area with a clear view all around; therefore, elaborate communications systems will not likely be necessary. Routine communications will be conducted verbally. Simple emergency hand signals for "stop digging", "shut off all power", and "withdraw from the area" will be arranged and reviewed in morning briefings. A portable compressed air horn will be available to the Safety Officer at all times and will be used as a signal for emergency evacuation.

Mobile telephones will be on-site during all activities and will be used to summon assistance as needed. A list of emergency phone numbers is included in this report in Attachment E and will be posted at the work Site command post.

F. Visitors

Approved visitors to the Site will adhere to the same safety and training requirements as work crews. They must present themselves to the site project manager and safety officer, be identified in the Safety Log, as a visitor, and sign the Visitor Certification, (Attachment F), acknowledging that they are aware of the hazards posed by the Site. Visitors will utilize the level of protective clothing and respiratory protection consistent with the portion of the Site he/she intends to visit. The level of protection will be consistent with the requirement's of the site work zone of activities, not the convenience of the visitor. Visitors will be properly decontaminated prior to exiting the work Site.

G. Personnel Protection

It is important that personal protective equipment and safety requirements be appropriate to protect against the potential or known hazards at an incident. Protective equipment will be selected based on the type(s), and concentration(s) of hazardous substances and the potential routes of personal exposure from substances at the Site. Previous analyses of soil samples have shown the presence of organic compounds and heavy metals in various concentrations in the subsurface. Continuous air monitoring for the presence of organic vapors will be carried out during all excavation and sampling activities. Monitoring will be performed with a photoionization detector supplemented with an explosimeter/oxygen meter and will normally take place in the "work zone". The work zone is considered the area within a twenty foot radius of performance of on-site activity. The work zone is the area in which workers may be directly exposed to variable concentrations and types of contaminants through disturbance of the soil.

Work at the Site will begin in Level D PPE. Continuous air monitoring to identify total atmospheric vapor concentration of hazardous substances and health hazards will be performed during all work activities to determine the appropriate level of employee protection needed. Air monitoring will be performed daily prior to commencement of on-site work in order to establish atmospheric background levels. These background levels will be recorded in

the safety log. These instruments will be maintained and calibrated as specified by the manufacturer. Daily calibration of all air monitoring equipment is mandatory.

The level of PPE will be upgraded to Level C if vapors detected in the work zone exceed 10 ppm for greater than five minutes. In the event that vapor concentration detected in the work zone exceed the IDLH for any of the known compounds (250 ppm (Phenol)), workers will be withdrawn and a two-man team dressed in Level B PPE will enter the work zone to monitor the atmosphere prior to allowing workers to resume work in Level C.

H. Personal Protective Equipment Rationale

Level B Protection

Level B Personal Protective Equipment will be required when the types and concentrations of hazardous substances are unknown (drum/drum contents) and will provide the highest degree of respiratory protection with maximum dermal exposure protection.

Level B will be worn when:

1. Immediately Dangerous to Life and Health (IDLH) atmospheres are indicated. (The IDLH value for a given compound is defined as the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.)
2. Types and concentrations of vapors in the air could present a dermal/contact hazard.
3. Atmospheres with less than 19.5% oxygen.
4. Activities associated with intact drum removal, sampling, and overpacking will require the use of Level B PPE.

Level B PPE includes:

1. Full face, positive pressure supplied air breathing apparatus either SCBA or airline.
2. Hooded chemical resistant suit.
3. Chemical resistant gloves (inner and outer).
4. Disposable, chemical resistant outer boots.
5. Steel toe and steel shank inner boots.

6. Hard hat.

Level C Protection

Level C dress will be required when the types and concentrations of hazardous substances are known and can be adequately addressed with full face air purifying respirators and dermal exposure will be minimal. Level C protection will be worn when:

1. Known materials have adequate warning properties.
2. Air concentrations of known materials do not require a protection factor greater than that afforded by a full-face air purifying respirator - 50 x Threshold Limit Value-Time Weighted Average (TLV-TWA) concentration. (The TLV-TWA for a given chemical is defined as an average concentration to which all workers may be repeatedly exposed for a normal 8-hour workday and 40-hour workweek without adverse effect.)
3. Proper respirator cartridges are available. Cartridges will be OV/AG with HEPA filters for all class C activities performed at the site.
4. Dermal exposure to unprotected areas of the body is nonexistent.
5. Continuous air and personnel monitoring is carried out during on-site activities.

Level C PPE consists of:

1. Full face, air purifying chemical cartridge respirator with appropriate cartridges, (OV/AG with HEPA filters will be required).
2. Hooded chemical resistant suit.
3. Chemical resistant gloves (inner and outer).
4. Disposable, chemical resistant outer boots.
5. Steel toe and steel shank inner boots.
6. Hard hat. Level C will be required during all PCB/Pb characterization activities.

Level D Protection

Level D personal protective equipment is basic work clothing. Level D equipment will be whom when:

1. There are no indications of airborne health hazards present, *i.e.*, air monitoring indicates vapor concentrations in the "working zone" at less than 10 ppm.
2. Continuous air or personnel monitoring will occur during on-site activities.

Level D equipment includes:

1. Work clothes/coveralls
2. Steel toe and steel shank boots.
3. Hard hat.
4. Safety glasses, safety goggles, or face shield.

   (Level D equipment may be augmented with disposable coveralls, outer boots, and gloves to minimize dermal contact).

The area within a 20-foot radius of the "work zone" will be designated as the "support zone". The "support zone" will contain equipment and personnel necessary for the decontamination of personnel and equipment. Drums in which contaminated disposable equipment, such as gloves, boots, etc., will be placed in the "support zone" for containment and future disposal. The "support zone" may also contain a shaded rest area, seats, and fluids for Site personnel based on atmospheric temperature and associated personnel protective equipment stress conditions. The area adjacent to the "support zone" will be called the "clean zone". Equipment, materials, and personnel not involved with "work zone" or "support zone" activities will be stored/staged in the "clean zone." Shade, seats, and fluids will be made available to site personnel in the "clean zone". ALL PERSONNEL AND EQUIPMENT WILL BE PROPERLY DECONTAMINATED PRIOR TO ENTRY TO THE "CLEAN ZONE".

I. Decontamination

Decontamination of personnel and equipment will be implemented at designated permanent or mobile locations to minimize or eliminate the potential spread of contamination and control personnel exposure to contaminants.

Specific decontamination procedures will be implemented as deemed appropriate for each specific site activity. If deemed necessary by the Site Safety Officer or Project Manager, a formal decon line with equipment drop and contaminant reduction stations for washing and removal of PPE garments will be implemented.

The Safety Officer or a designated alternate will visually inspect all equipment used for digging or soil sampling to ensure that effective decontamination has been performed. All respirators used at the Site will be sanitized daily.

J. General Safety Practices

There will always be a minimum of two people on Site during performance of all work activities. Direct communication will be maintained at all times.

Contact with contaminated or potentially contaminated surfaces without proper PPE is to be avoided. Site personnel will not sit, lean, or stand on contaminated equipment, containers or other surfaces or walk through puddles or discolored areas.

Eating, drinking, chewing gum or tobacco, or smoking will be permitted only in designated areas.

Site personnel will wash face, hands, and forearms prior to eating, drinking, or any other activity that could cause ingestion of contaminants.

No facial hair which interferes with the satisfactory fit of respiratory protection is allowed on personnel. Personnel performing site activities will have passed an off-site quantitative fit-test for the respirator to be worn in the field prior to performing field activities. Fit test documents and records will be required as part of the project file.

Site workers will report any and all accidents to the Safety Officer or alternate, regardless of severity.

K. Generic Site Hazards or Incidents and Standard Operating Procedures

Hazard: Chemical Exposure

SOP: Ensure that proper PPE is used and upgraded as necessary; if exposure occurs, consult reference documents on-site for first aid procedures and seek medical attention as soon as possible.

A list of known on-site chemical compounds and review characteristics which may be encountered on-site based on past sampling events has been prepared and is presented per attachment B of this document.

Hazard: Cold Stress

SOP: Ensure Site workers are properly attired with clothing, adequate to protect them from cold; provide heated shelter for break area;

know treatment and watch for the symptoms of frost nip, frost bite, and hypothermia; if practical, erect wind breaks/deflectors.

Hazard: Heat Stress

SOP: Provide sufficient break/cool down periods for level of PPE being used, provide shaded break area, provide drinks for replenishment of body fluids and materials (do not use salt tablets), monitor for symptoms of heat stress through visual observations. Know treatment method and symptoms of heat rash, heat cramps, heat exhaustion, and heat stroke.

Hazard: Electrical Power

SOP: Ensure applicable OSHA standards for electrical power are adhered to, have ground fault circuit interrupter on all circuits in use at the Site, have "dead man stick" available to move people or power lines.

Hazard: Slip, trip, and fall

SOP: Keep work area free of trip hazards, be aware of surroundings and activities taking place in them, provide sufficient lighting during low light conditions (*i.e.*, early morning, early evening, and night).

Hazard: Low light

SOP: No operations will be conducted during low light conditions for this project.

Hazard: Splashes from chemical compounds

SOP: Use proper PPE (*i.e.*, safety glasses, face shield, gloves, coveralls, etc.); know the locations of emergency eyewash stations.

Hazard: Drum handling

SOP: Drums will be used to contain contaminated PPE and other disposables. Drum handling will be in accordance with OSHA regulations (29 CFR 1910-120(j)).

Hazard: Heavy equipment operations

SOP: Minimize number of persons working, around moving, equipment maintain direct communication with the operator, equip machinery with back-up warning devices, use only properly trained operators.

Hazard: Heavy rain and thunderstorms

SOP: Stop work, shut down non-essential equipment, seek shelter out of drainage-ways and away from lightning attractors (trees, backhoe, power poles, etc.).

Hazard: Fire

SOP: Conduct operations to minimize risk of fire, use non-sparkling, tools whenever appropriate; have appropriate class(es) of fire extinguishers available at the Site; do not refuel equipment that is in operation; ground equipment, fuel cans, and drums of flammable materials. If fire occurs on-site, respond defensively if practical and alert the fire department; if fire is uncontrollable with available equipment, evacuate to a safe distance.

SPECIFIC HAZARDS ASSOCIATED WITH EXCAVATION:

Hazard: Utilities, buried and overhead

SOP: Survey area prior to setting up, avoid locations with overhead utilities if possible. Utility companies will be consulted prior to on-site activities for information regarding locations of buried utilities; these will be marked for continual reference.

Hazard: Flying debris from damaged excavation equipment

SOP: Pay attention to stresses that being placed on equipment, could result in breakage; ensure all Site workers know the location for "kill switches" on all heavy equipment.

Hazard: Confined space entry

SOP: No personnel entry into site trenches will be allowed for any reasons.

L. Medical Monitoring Program

Proof of participation in a medical monitoring program will be mandatory for each individual working at the site.

ATTACHMENT A

SITE SAFETY LOG

Project: Location: Date: _____ Sheet _____ of _____

Personnel: Safety Officer Others:

Known Hazards:

Weather:

SITE ACTIVITIES - Include instruments used, calibration, instrument readings, injuries, PPE in use, visitors, etc.

TIME	ACTIVITIES

ATTACHMENT B

KNOWN ON-SITE CHEMICAL COMPOUNDS AND SELECTED CHARACTERISTICS

NOTE: The compounds or farming of compounds listed below have been identified in samples taken from soil and waters form previous sampling events at the Site.

Information regarding chemical characteristics included in this list was taken from Hawley's Condensed Chemical Dictionary, 11th Edition; Rev. by N.I. Sax and R.L. Lewis, Sr. All TLV-TVA information was taken from the 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices compiled by the American Conference of Governmental Industrial Hygienists (ACGIH). All IDLH and exposure symptom information was taken from the National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards - 1990.

Ethylbenzene (CAS # 100-41-4)
Properties: Colorless liquid, aromatic odor, vapor heavier than air, flash point = 59F
Hazards: Toxic by ingestion skin absorption and inhalation; irritant to skin and eyes; flammable
TLV: 100 ppm
IDLH: 2,000 ppm
Symptoms: Irritation of the eyes and mucous membranes; headache, narcosis and eventual coma

Toluene (CAS # 108-88-3)
Properties: Colorless liquid, aromatic odor, flash point = 4OF
Hazards: Toxic by ingestion, inhalation and absorption; flammable
TLV: 100 ppm
IDLH: 2,000 ppm
Symptoms: Fatigue; weakness; confusion; euphoria; dizziness; headache; dilated pupils; lacrimation; nervousness; muscle fatigue; insomnia; paresthesia and dermatitis

Xylene (CAS # 1-D30-20-7)
Properties: Clear liquid, flash point = 81-115F
Hazards: Toxic by ingestion and inhalation, flammable
TLV: 100 ppm
IDLH: 1,000 ppm
Symptoms: Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose and throat; corneal vacuolization; anorexia; nausea; vomiting and abdominal pain

Tetrachloroethylene (or Perchloroethyiene CAS # 127-18-4)
Properties: Colorless liquid, ether-like odor, flash point - none
Hazards: Irritant to eyes and skin; potential carcinogen
TLV: 50ppm
IDLH: 500 ppm
Symptoms: Irritation of eyes, nose and throat; flushed face and neck; vertigo; dizziness; incoordination; headache; somnolence; skin erythema; liver damage

1,1-Dichloroethane (or Ethylene Chloride CAS # 75-34-3)
Properties: Colorless oily liquid, chloroform-like odor, flash point = 56F
Hazards: Toxic by ingestion, inhalation and skin absorption; strong irritant to eyes and skin, potential carcinogen; flammable
TLV: 10 ppm
IDLH: 4,000 ppm
Symptoms: Central nervous system depression; nausea; vomiting; dermatitis: irritation of eyes; corneal opacity

1,2-Dichloroethylene (CAS # 540-59-0)
Properties: Colorless liquid, pleasant odor, flash point = 39F
Hazards: Toxic by inhalation, ingestion and skin contact; irritant and narcotic in high concentrations; flammable
TLV: 200 ppm
IDLH: 4,000 ppm
Symptoms: Irritation of eyes and respiratory system; central nervous system depression

1,1,1-Trichloroethane (or Methyl Chloroform CAS # 71-55-6)
Properties: Colorless liquid, flash point - none
Hazards: Irritant to eyes and tissue
TLV: 350 ppm
IDLH: 1,000 ppm
Symptoms: Headache; lassitude; central nervous system depression; poor equilibrium; eye irritation; dermatitis and cardiac arrhythmias

Trichloroethylene (CAS # 79-01-6)
Properties: Colorless liquid, chloroform like odor, flash point - none
Hazards: Toxic by inhalation; potential carcinogen
TLV: 50 ppm
IDLH: 1,000 ppm
Symptoms: Headache; vertigo; visual disturbance; tremors: somnolence; nausea; vomiting; eye irritation; dermatitis; cardiac arrhythmias and paresthesia

Vinyl Chloride (CAS # 75-01-4)
Properties: Compressed gas easily liquified, usually handled as liquid, ether-like odor, flash point = -109F
Hazards: Toxic by all routes of exposure; a carcinogen; highly flammable
TLV: 5 ppm

IDLH: none available
Symptoms: Weakness; abdominal pain; gastrointestinal bleeding; hepatomegaly; pallor or cyanosis of extremities

Phenol (CAS # 108-95-2)
Properties: White crystalline mass when not in solution, typically used in solution, distinctive odor, flash point = 172F
Hazards: Toxic by ingestion inhalation and skin absorption; strong irritant to tissue
TLV: 5ppm
IDLH: 250 PPM
Symptoms: Irritation of eyes, nose and throat; anorexia; weight loss; muscle aches and pains; dark urine; tremors; convulsions; twitching; dermatitis; ochronosis

Naphthalene (CAS # 91-20-3)
Properties: White crystalline flakes, strong coal/tar odor, flash point = 176F
Hazards: Toxic by inhalation
TLV: 10 ppm
IDLH: 500 ppm
Symptoms: Eye irritation; headache; confusion; excitement; malaise; nausea; vomiting; abdominal pain; irritation of the bladder; profuse sweating; jaundice; hemoglobinuria; renal shutdown and dermatitis

Phenanthrene (CAS # 85-01-8)
Properties: Colorless shining crystals when not in solution
Hazards: A potential carcinogen; combustible
TLV: none available
IDLH: none available

Fluoranthene (CAS # 206-44-0)
Properties: Colored needles when not in solution
TLV: none available
IDLH: none available

Petroleum Hydrocarbons (diesel fuel, motor oil, etc.)
Properties: Viscous liquid (depending on grade), unpleasant odor
Hazards: Toxic by ingestion; local skin irritant; moderate fire risk
TLV: none available
IDLH: none available

Lead (asPb) (CAS # 7439-92-1), as noted per NIOSH, Pocket Guide to Chemical Hazards, June 1990" OSHA considers "Lead" to mean metallic Pb, all inorganic Pb compounds (Pb oxides and Pb salts) and a class of organic Pb compounds called soaps. All other organic Pb compounds are excluded from this definition". No "lead dust" is anticipated at the site.
Properties: Metal, a heavy ductile, soft gray solid
TWA: "Dust" - NIOSH 0.100 mg/m^3

IDLH: 700 mg/m^3
Symptoms: Weakness, lassitude, insomnia, facial pallor, anorexia, weight loss, anemia, tremors, encephalopathy, nephropathy, hypotension, irritated eyes

PCB 1248: No data per AGGIH (1991), NIOSH Pocket Guide to Chemical Hazard, Organic Vapor/Acid Gas/HEPA dust filters will be mandatory

PCB 1242 - Aroclor 1242 (CAS # 53469-21-9)
PCB, polychlorizated biphenyl, chlordiphenyl (42% chlorine)
Properties: Colorless to light colored, vicious liquid with a mild hydrocarbon odor, BP: 617-691°F, insolerable, vapor pressure: 0.001 mm. Nonflammable liquid, exposure to fire results in formation of black foot, containing PCBs, polychlorizated debenzoturan, and chlorinated dibenzo-p-dioxins. Carcinogenic (NIOSH). Understudy by ACGIH to Establish Biological Exposure Indices.
Exposure limits: NIOSH - 0.001 mg/m^3
TWA OSHA - 1 mg/m^3 (skin)
IDLH NIOSH - 10.0 mg/m^3
Symptoms: Irritated eyes, chloracne, liver damage.
Protection: Class C PPE will be required for all personnel in the work zone.

ATTACHMENT C

LIST OF ON-SITE SAFETY EQUIPMENT

Full-Face Respirators (x number of on-site workers)

Organic Vapor/Acid Gas and HEPA Respirator Cartridges (4x number of on-site workers)

Class D/C/B protective clothing (disposable clothing *i.e.*, boots, gloves, etc.) (3 changes/person per day - minimum)

Duct Tape - 12 rolls

Steel-Toe Safety Shoes/Boots

First Aid Kit(s) - 1 at site clean area/1 at command post

Eyewash Stations - 2 minimum (field/command posts)

Safety Glasses (x number of on-site workers)

D.O.T. overpacks (10) - 85 gallon (poly or lined steel)

D.O.T. 17H55 Drums (10)

6 Millimeter Polyethylene Plastic (12 rolls)

Hard Hats

Air Horn

Mobile Telephones

Fire Extinguishers (all heavy equipment, one on-site, one at command post)

Water Cooler(s) and Drinking Cups/Electrolite solution> - (2 minimum - 5 gallon capacity)

Photoinization Detectors (2)

Explosimeter/Oxygen Meter (1)

Brushes - As required for decontamination - various sizes

Plastic Decon Pools - (2 on site/2 at command post storage area)

LIST OF ON-SITE SAFETY EQUIPMENT (Continued)

Detergent - As required for decontamination

Water Source (hose(s) or tank, if necessary): Water from existing utilities will be available for use as wash and portable waters

Blanket(s) - Fire type (2 available at command post storage)

Stretcher - 1 at command post storage

Chemical Exposure Contingency Reference(s) - D.O.T./NIOSH/ACGIH Handbooks/Documents

Self Contained Breathing Apparatus (4) - with spare cylinders (4) on site

Tripod and Safety Harness (1)

Spark Free Tools (1 set)

Vapor suppressory blanket material - (8 rolls)

Portable shade kits (1 on site/ 1 spare at command post storage)

ATTACHMENT D

HAZARDOUS WASTE SITE WORKER CERTIFICATION

I certify that I have been informed of the hazards associated with the Sadd Site on Trousdale Drive, Davidson County, Tennessee, and that I have training or experience required by 29 CFR 1910.120.

Date	Printed Name	Signature	Employer

ATTACHMENT E

LIST OF EMERGENCY TELEPHONE NUMBERS/SITUATIONS

Emergency/emergency situation requiring fire department, police, or medical attention 911

Fire Department/fire or explosion or imminent threat of same 327-1300

Police Department/any emergency situation 862-7400

Coast Guard National Response Center/reportable quantity release of hazardous substance 1-800-424-8802

Tennessee Emergency Management Agency/reportable quantity release of hazardous substance, any significant emergency situation 741-0001

CHEMTREC/chemical information 1-800-424-9300

Poison Control Center/ingestion of chemical 322-6435

Tennessee Occupational Medicine/non-emergency exposure to chemical 321-4800

Utility One-Call/underground utility identification 366-1987

Southern Hills Medical Center/medical emergency 781-4600

ATTACHMENT F

HAZARDOUS WASTE SITE VISITOR CERTIFICATION

I certify that I have been informed of the hazards associated with the Sadd Site on Trousdale Drive, Davidson County, Tennessee. I agree to comply with directions given to me by the Safety Officer.

Date	Printed Name	Signature	Employer

APPENDIX III

APPENDIX III

SAL-QC-REV 2 / 92
DATE: 2-25-92
SECTION: 1.0
PAGE: 1 of 1

Danny B. Hale, M.S. Technical Director

Theodore J. Duello, Ph.D QA / QC Officer

COMPREHENSIVE QUALITY ASSURANCE PLAN
FOR
SPECIALIZED ASSAYS, INC.
300 12th Avenue South
Nashville, Tennessee 37203

(800) 765-0980 • (615) 726-0177 • Fax (615) 726-3404

Table of Contents

Quality Assurance Plan

Tables

FIGURES

3.0 STATEMENT OF POLICY

3.1 PURPOSE

It is our goal as an analytical laboratory to supply scientifically correct data of known precision and accuracy. The quality assurance plan described in this document is a component of an overall effort to produce data that is both legally and scientifically defensible.

This manual will describe management procedures and controls as well as general requirements for quality control procedures. Each method contained in our laboratory procedure manuals will have specific quality control steps outlined therein. The terms "quality assurance" and "quality control" will be defined for the purpose of this manual as follows:

QUALITY ASSURANCE: Those procedures, policies, objectives, and principles which when properly integrated into the total laboratory system, are intended to produce data of known quality.

QUALITY CONTROL: Functional, specific actions taken by the analyst to verify processes within the laboratory.

The importance of activities described in this manual are conveyed by use of the words "must", "may", and "shall". The words "must" and "shall" indicate actions which are required. The word "may" indicates an action which is not required but is recommended. Some recommended actions may actually be required by some of the individual procedures contained in laboratory procedure manuals.

3.2 RESPONSIBILITIES AND GUIDELINES FOR PERSONNEL

While the Laboratory Director is responsible for the quality of data produced, the Quality Assurance Director is responsible for the daily monitoring of the QA program. Reporting directly to the lab manager, he will make recommendations for corrective actions as needed.

All personnel will strive to meet the requirements of the QA program as it relates to their specific area of the laboratory while maintaining appropriate records to confirm that all quality control procedures are being followed. All personnel will have access to these documents and are encouraged to discuss the contents with management at any time; however, no deviations from the procedures found herein will be made without the approval of the laboratory QA manager and the Laboratory Director.

The laboratory QA officer will supervise the training and evaluation of all new personnel to insure that everyone performing laboratory analyses are thoroughly familiar with the program described in this manual. Documented results of training procedures will be kept on file in the personnel office.

4.0 ORGANIZATION AND RESPONSIBILITY

4.1 PURPOSE

To function smoothly, members of the staff must clearly understand and meet their responsibilities as they relate to quality control. Those responsibilities are outlined in this section and are graphically represented in Figure 4-1.

4.2.1 Laboratory Manager and Technical Director

This individual will be responsible for the following:

1. Design and implementation of the QA program within the laboratory.

2. Provide the technical direction of the laboratory as related to systems and procedures. Some authority may be delegated to appropriate individuals depending upon the situation, however, the final responsibility lies solely with the Technical Director.

3. Work with the QA officer to monitor and modify if necessary the components of the QA program.

4. Approve all changes in procedures or quality control.

5. Approve all data before reporting to clients.

6. Design and maintain a laboratory organizational chart.

7. Supervise the proficiency testing programs offered by various regulatory agencies.

4.2.2 Quality Assurance Officer

This individual will be responsible for the following:

1. Daily monitoring of quality control procedures.

2. Maintenance of appropriate QC charts and documents.

3. Document QC errors and work with the supervisor to develop a plan of corrective action.

4. Initiate an in-house proficiency evaluation program involving blind samples.

5. Keep the lab manager and supervisors apprised of the general state of the quality assurance program.

4.2.3 Sample Officer

This individual will be responsible for the following:

1. Supervise the log-in of all samples into the computer system.

2. Monitor daily worksheets to assure that samples are analyzed within appropriate holding times.

3. Report to the laboratory manager any anomalies in sample handling, e.g., samples not analyzed within holding times.

4. Insert into the system appropriate quality control samples, i.e., blanks, spikes, etc...

5. Supervise the storage of samples from the time they are received in the laboratory until disposal.

6. Maintain all chain of custody documents.

7. Serve as the focal point for client inquiries.

8. Supervise the distribution of appropriate sample containers to clients.

4.2.4 Supervisors

These individuals will be responsible for the following:

1. Evaluation of instruments, software, and personnel performance in their section. This will involve making recommendations to the laboratory manager on matters pertaining to the selection of equipment and personnel including yearly personnel performance evaluations.

2. Maintenance of instrumentation such that the equipment is in proper condition to allow the data produced to be of high quality.

3. Supervise the analysis of all samples including QC samples. These results should be evaluated against appropriate control limits and decisions made as to the acceptability of data.

4. Maintenance of QC records in an orderly manner such that the lab manager, QA officer, regulatory agents and clients can readily review the data.

5. Report immediately to the lab manager any problems that will affect the quality of data. This includes both analytical and holding time problems.

6. The supervisor will be directly responsible for the daily operation of their area. This includes scheduling of personnel and communication of necessary information to all other areas.

4.2.5 Analytical Chemists

The laboratory analysts are responsible for the following:

1. The performance of all analytical procedures according to approved protocol. This will include the analysis of appropriate QC material and the recording of data obtained from those analyses.

2. The analyst will report any out of control situations directly to the area supervisor before reporting the data.

3. The analyst will familiarize himself with the manufacturers recommended maintenance schedule for instruments in his area, and will perform and document those maintenance steps.

4.2.6 Education / Training of Personnel

Qualifications of laboratory personnel will be as follows:

1. Minimum education requirement will be a bachelors of science degree from an accredited four year college or university.

2. Experience will be a minimum of six months to two years relative to the specific performance requirements.

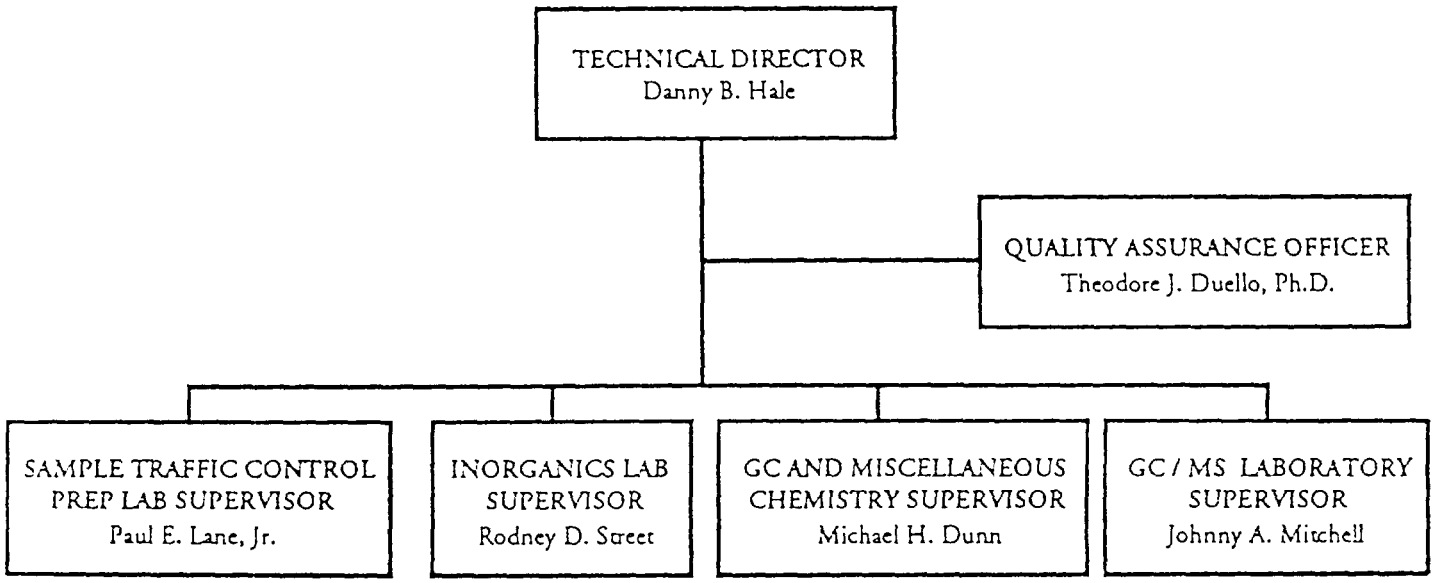
3. All analyst will be trained internally in QA procedures and protocols.

4. Each analyst must demonstrate proficiency in the respective test procedures and will be approved by the area supervisor and QA Director prior to reporting analytical data.

5. Documentation of all education, training, and previous employment experience will be retained in personnel files.

FIGURE 4 -1

LABORATORY ORGANIZATIONAL CHART



5.0 QUALITY ASSURANCE OBJECTIVES

Analytical methods used for the extraction, digestion, preparation, and analysis of organic and inorganic analytes are listed in Tables 5-1, 5-2, 5-3, 5-4, 5-5, and 5-6. Accuracy is percent recovery within a statistically acceptable range. Precision numbers relate to the degree of correlation between duplicate pairs of samples taken through the analytical process. Method detection limits represent the lowest concentration of analytes that can be reported with confidence.

TABLE 5-1

APPROVED SAMPLE PREPARATION PROCEDURES

SAMPLE PREP	METHOD	MATRIX	APPLICABLE METHODS
Acid Digestion	3010	Water	6010
Acid Digestion	3020	Water	7041, 7060, 7131, 7191 7421, 7740, 7761, 7841
Acid Digestion	3050	Soil, Solid Wastes	6010, 7041, 7060, 7131 7191, 7421, 7740, 7761 7841
Separatory Funnel Extraction	3510	Water	8080, 8270
Ultrasonic Extraction	3550	Soil, Solid Wastes	8080, 8270
Clean-up	3610	Water, Soil	8080, 8270

Test Methods for Evaluating Solid Waste, EPA SW-846, Third Edition, November, 1986.

TABLE 5-2

APPROVED INORGANIC TEST PROCEDURES

MATRIX

PARAMETER	WASTE WATER	SURFACE WATER	GROUND WATER	SOIL	TCLP EXTRACTS
Acidity	305.1	305.1			
Alkalinity	310.1	310.1			
Aluminum	200.7	200.7	6010	6010	6010
Ammonia Nitrogen	350.3	350.3			
Antimony	204.2	204.2	7041	7041	7041
Arsenic	206.2	206.2	7060	7060	7060
Barium	200.7	200.7	6010	6010	6010
Beryllium	200.7	200.7	6010	6010	6010
BOD	405.1	405.1			
Boron	200.7	200.7	6010	6010	6010
Cadmium	200.7 / 213.2	200.7 / 213.2	7131 / 6010	7131 / 6010	7131 / 6010
Calcium	200.7	200.7	6010	6010	6010
COD	410.2	410.2			
Chloride	300	300	9250	9250	
Chromium IV	218.4	218.4	7197	7197	
Chromium	200.7 / 218.2	200.7 / 218.2	7191 / 6010	7191 / 6010	7191 / 6010
Cobalt	200.7	200.7	6010	6010	6010
Color	110.3	110.3			
Copper	220.2 / 200.7	220.2 / 200.7	6010	6010	6010
Cyanide	335.2	335.2	9010	9010	
Fluoride	340.2	340.2	340.2		
Hardness	130.1	130.1			
Iron	200.7	200.7	6010	6010	6010
Kjeldhal Nitrogen	351.4	351.4			
Lead	239.2 / 200.7	239.2 / 200.7	7421 / 6010	6010	7421 / 6010
Magnesium	200.7	200.7	6010	6010	6010
Manganese	200.7	200.7	6010	6010	6010
Mercury	245.2	245.2	7470	7471	7470
Molybdenum	200.7	200.7	6010	6010	6010
Nickel	200.7	200.7	6010	6010	6010
Nitrate Nitrogen	352.1	352.1	9200	9200	

Nitrite Nitrogen	354.1	354.1			
Oil & Grease	413.1	413.1			
pH	150.1	150.1	9040	9045	
Total Organic Carbon	415.1	415.1	9060		
Total Organic Halogen			9020		
Phenols	420.2	420.0	9065		
Potassium	200.7	200.7	6010	6010	6010
Selenium	270.2	270.2	7740	7740	7740
Silver	272.2	272.2	6010	6010	6010
Sodium	200.7	200.7	6010	6010	6010
Solids					
Total	160.3	160.3			
Suspended	160.1	160.1			
Dissolved	160.2	160.2			
Volatile	160.4	160.4			
Specific Conductance	120.1	120.1	9050		
Sulfate	300	300	300		
Thallium	279.2	279.2	7841	7841	7841
Tin	200.7	200.7	6010	6010	6010
Titanium	283.2	283.2			
Turbidity	180.1	180.1			
Vanadium	200.7	200.7	6010	6010	6010
Zinc	200.7	200.7	6010	6010	6010

TABLE 5-3

APPROVED ORGANIC TEST PROCEDURES

MATRIX

PARAMETER	WASTE WATER	SURFACE WATER	GROUND WATER	SOIL	TCLP EXTRACTS
Volatile Organic Chemicals	624	624	8240	8240	8240
Semivolatile Organic Chemicals	625	625	8270	8270	8270
Halogenated Volatile Organic Chemicals	601	601	8010	8010	8010
Non-halogenated Volatile Organics			8015	8015	8015
Aromatic Volatile Organic Chemical	602	602	8020	8020	8020
Halogenated Pesticides and PCB's	608	608	8080	8080	8080
Polynuclear Aromatic Hydrocarbons	610	610	8310	8310	8310
Chlorinated Herbicides			8150	8150	8150
Total Petroleum Hydrocarbons	418.1	418.1	8015[1]	8015[1]	8015[1]

NOTES:

1 Method 8015 as modified by the Tennessee Department of Health and Environment for the determination of gasoline and diesel range organics in water and soil.

TABLE 5-4

QUALITY ASSURANCE OBJECTIVES

SOIL AND SOLID WASTE

ANALYTE	METHOD	ACCURACY	PRECISION	MDL
Chloride	9056	95-105	0 - 3	0.18 ppm
Fluoride	9056	94-110	0 - 3	0.15 ppm
Sulfate	9056	96-105	0 - 3	1.50 ppm
Nitrate N	9056	97-103	0 - 3	0.05 ppm
TOC	9060	84-110	0 - 3	1.62 ppm
Cyanide	9010	94-106	0 - 5	0.01 ppm
Phenolics	9065	85-115	0 - 5	0.02 ppm
pH	9040 / 9045	98-102	0 - 1	0.1 pH units
Aldrin	8080	42-122	0 - 21	4.08 ppb
a-BHC	8080	37-134	0 - 24	4.01 ppb
b-BHC	8080	17-147	0 - 32	2.66 ppb
d-BHC	8080	19-140	0 - 36	2.66 ppb
g-BHC	8080	32-127	0 - 23	3.90 ppb
Chlordane	8080	45-119	0 - 20	8.93 ppb
4, 4-DDD	8080	31-141	0 - 28	3.06 ppb
4, 4-DDE	8080	30-145	0 - 28	2.41 ppb
4, 4-DDT	8080	25-160	0 - 36	6.95 ppb
Dieldrin	8080	36-146	0 - 38	1.54 ppb
Endosulfan I	8080	45-153	0 - 25	3.70 ppb
Endosulfan II	8080	1-202	0 - 61	2.06 ppb
Endosulfan sulfate	8080	26-144	0 - 27	6.90 ppb
Endrin	8080	30-147	0 - 37	1.68 ppb
Endrin Aldehyde	8080	30-147	0 - 37	8.82 ppb
Heptachlor	8080	34-111	0 - 20	3.43 ppb
Heptachlor epoxide	8080	37-142	0 - 21	2.24 ppb
Methoxychlor	8080	60-120	0 - 30	41.1 ppb
Toxaphene	8080	41-126	0 - 25	7.73 ppb
PCB 1016	8080	50-114	0 - 20	71.0 ppb
PCB 1221	8080	15-178	0 - 49	41.3 ppb
PCB 1232	8080	10-215	0 - 36	126.0 ppb
PCB 1242	8080	39-150	0 - 24	69.7 ppb
PCB 1248	8080	38-158	0 - 32	38.7 ppb

PCB 1254	8080	29-131	0 - 28	78.1	ppb
PCB 1260	8080	8-127	0 - 21	146.0	ppb
2, 4-D	8150	31-120	0 - 20	1.54	ppb
2, 4, 5-TP	8150	41-114	0 - 20	0.78	ppb
Aluminum	6010	85-115	0 - 6.7	2.0	ppm
Antimony	7041	70-130	0 - 12.0	2.0	ppm
Arsenic	7060	85-115	0 - 10.2	1.0	ppm
Barium	6010	85-115	0 - 2.65	0.5	ppm
Beryllium	6010	88-112	0 - 1.83	0.5	ppm
Cadmium	6010	88-112	0 - 1.88	0.5	ppm
Calcium	6010	90-110	0 - 3.05	5.0	ppm
Chromium	6010	85-115	0 - 3.51	1.0	ppm
Cobalt	6010	85-115	0 - 1.72	1.0	ppm
Copper	6010	90-110	0 - 2.69	1.0	ppm
Iron	6010	90-110	0 - 3.60	3.0	ppm
Lead	6010	90-110	0 - 2.91	4.0	ppm
Magnesium	6010	85-115	0 - 3.98	5.0	ppm
Manganese	6010	85-115	0 - 2.48	1.0	ppm
Molybdenium	6010	85-115	0 - 4.00	5.0	ppm
Mercury	7471	90-110	0 - 2.82	0.1	ppm
Nickel	6010	90-110	0 - 2.41	2.0	ppm
Potassium	6010	90-110	0 - 3.83	15.0	ppm
Selenium	7740	95-105	0 - 5.16	1.0	ppm
Silver	6010	90-110	0 - 5.16	2.0	ppm
Sodium	6010	90-110	0 - 7.53	10.0	ppm
Thallium	7841	90-110	0 - 3.17	1.0	ppm
Vanadium	6010	85-115	0 - 2.03	5.0	ppm
Zinc	6010	85-115	0 - 3.41	1.0	ppm
Acenapthene	8270	60-132	0 - 27.6	69.0	ppb
Acenapthylene	8270	54-126	0 - 40.2	116.0	ppb
Anthracene	8270	43-118	0 - 32.0	66.0	ppb
Benzo (a) anthracene	8270	42-133	0 - 27.6	112.0	ppb
Benzo(b)fluoranthene	8270	42-140	0 - 38.8	178.0	ppb
Benzo(k)fluoranthene	8270	25-146	0 - 32.3	218.0	ppb
Benzo(a)pyrene	8270	32-148	0 - 39.0	244.0	ppb
Benzo(ghi)perylene	8270	10-195	0 - 58.9	224.0	ppb
Butylbenzl phthalate	8270	10-140	0 - 23.4	221.0	ppb
Bis(2-chloroethyl) ether	8270	43-126	0 - 55.0	83.0	ppb
Bis(2-choroethoxy) methane	8270	49-165	0 - 34.5	132.0	ppb

Bis(2-chloroiso-propyl) ether	8270	63-139	0 - 46.3	89.0	ppb
Bis(2-ehtylhexyl) phthalate	8270	29-137	0 - 41.1	86.0	ppb
4-Bromophenyl-phenylether	8270	65-114	0 - 23.0	175.9	ppb
2-Chloronapthalene	8270	65-114	0 - 13.0	69.0	ppb
4-Chlorophenyl-phenylether	8270	38-145	0 - 23.0	180.0	ppb
Chrysene	8270	44-140	0 - 48.3	112.0	ppb
Dibenzo(ah) anthracene	8270	10-200	0 - 70.0	185.0	ppb
Di-n-butyl phthalate	8270	10-111	0 - 16.7	168.0	ppb
1,2-Dichloro benzene	8270	49-112	0 - 30.9	73.0	ppb
1,3-Dichloro benzene	8270	17-154	0 - 41.7	73.0	ppb
1,4-Dichloro benzene	8270	37-106	0 - 32.1	63.0	ppb
3,3-Dichloro benzidine	8270	8-213	0 - 70	300.0	ppb
Diethylphthalate	8270	10-100	0 - 26.5	188.0	ppb
Dimethylphthalate	8270	10-100	0 - 23.2	205.0	ppb
2,4-Dinitrotoluene	8270	48-127	0 - 21.8	294.0	ppb
2,6-Dinitrotoluene	8270	68-137	0 - 29.6	274.0	ppb
Di-n-octylphthalate	8270	19-132	0 - 31.4	195.0	ppb
Fluoranthene	8270	43-121	0 - 32.8	155.0	ppb
Fluorene	8270	72-108	0 - 20.7	228.0	ppb
Hexachlorobenzene	8270	10-141	0 - 24.9	241.0	ppb
Hexachloro butadiene	8270	38-102	0 - 26.3	99.0	ppb
Hexochlorocyclo pentadiene	8270	10-141	0 - 50.0	250.0	ppb
Hexachoroethane	8270	55-100	0 - 24.5	83.0	ppb
Indeno(123-cd) pyrene	8270	10-150	0 - 44.6	205.0	ppb
Isophorone	8270	47-180	0 - 63.3	208.0	ppb
Napthalene	8270	36-120	0 - 30.1	79.0	ppb
Nitrobenznene	8270	54-158	0 - 39.3	168.0	ppb
Nitroso-di-N-propylamine	8270	14-198	0 - 55.4	162.0	ppb
Phenanthrene	8270	65-109	0 - 20.6	86.0	ppb

Pyrene	8270	70-125	0 - 25.2	284.0	ppb
1,2,4-Trichloro benzene	8270	57-129	0 - 28.1	122.0	ppb
4-Chloro-3-methyl phenol	8270	41-128	0 - 37.2	129.0	ppb
2-Chlorophenol	8270	36-120	0 - 28.7	152.0	ppb
2,4-Dichlorophenol	8270	53-122	0 - 26.4	257.0	ppb
2,4-Dimethylphenol	8270	42-109	0 - 26.1	208.0	ppb
2,4-Dinitrophenol	8270	10-173	0 - 49.8	168.0	ppb
2-Methyldinitro phenol	8270	53-100	0 - 50.0	300.0	ppb
2-Nitrophenol	8270	45-167	0 - 35.2	188.0	ppb
4-Nitrophenol	8270	13-107	0 - 47.2	419.0	ppb
Pentachlorophenol	8270	38-152	0 - 48.9	264.0	ppb
Phenol	8270	17-100	0 - 22.6	132.0	ppb
2,4,6-Trichloro phenol	8270	52-129	0 - 31.7	241.0	ppb
Benzene	8240	76-130	0 - 6.9	1.56	ppb
Bromodichloro methane	8240	66-130	0 - 6.4	2.29	ppb
Bromoform	8240	71-124	0 - 5.4	2.38	ppb
Bromomethane	8240	50-125	0 - 17.9	2.84	ppb
Carbontetra chloride	8240	86-117	0 - 5.2	2.20	ppb
Chlorobenzene	8240	82-134	0 - 6.3	1.56	ppb
Chloroform	8240	69-121	0 - 6.1	1.42	ppb
Chloromethane	8240	60-130	0 - 19.8	6.16	ppb
Dibromochloro methane	8240	69-133	0 - 6.1	1.56	ppb
1,1-Dichloro ethane	8240	73-128	0 - 5.1	1.42	ppb
1,2-Dichloro ethane	8240	71-132	0 - 6.0	1.42	ppb
1,1-Dichloro ethane	8240	51-150	0 - 9.1	1.56	ppb
t-1,2-Dichloro ethane	8240	70-131	0 - 5.7	1.10	ppb
1,2-Dichloro-propane	8240	34-166	0 - 13.8	1.68	ppb
c-1,3-Dichloro propene	8240	25-150	0 - 15.8	2.20	ppb

t-1,3-Dichloro propene	8240	50-150	0 - 10.4	2.77	ppb
Ethylbenzene	8240	87-134	0 - 7.5	1.42	ppb
Methylene Chloride	8240	61-140	0 - 7.4	2.77	ppb
1,1,2,2-Tetra chloroethane	8240	68-136	0 - 7.4	2.62	ppb
Tetrachloroethene	8240	85-133	0 - 5.0	2.01	ppb
Toluene	8240	83-125	0 - 4.8	1.10	ppb
1,1,1-Trichloro ethane	8240	75-125	0 - 4.6	2.20	ppb
1,1,2-Trichloro ethane	8240	71-129	0 - 5.5	2.20	ppb
Trichloroethene	8240	93-134	0 - 6.6	2.01	ppb
Trichlorofluoro methane	8240	48-152	0 - 10.0	1.68	ppb
Vinyl Chloride	8240	50-150	0 - 20.0	2.84	ppb
Xylene	8240	75-125	0 - 5.0	1.56	ppb

TABLE 5-5

QUALITY ASSURANCE OBJECTIVES

GROUND WATER

ANALYTE	METHOD	ACCURACY	PRECISION	MDL	
Conductance	9050	90-110	0 - 2	0.03	uMHOS / cm
Chloride	9056	95-105	0 - 3	0.18	ppm
Fluoride	9056	94-110	0 - 3	0.15	ppm
Sulfate	9056	96-105	0 - 3	1.50	ppm
Nitrate N	9056	97-103	0 - 3	0.05	ppm
TOC	9060	84-110	0 - 3	1.62	ppm
Cyanide	9010	94-106	0 - 5	0.01	ppm
Phenolics	9065	85-115	0 - 5	0.02	ppm
pH	9040 / 9045	98-102	0 - 1	0.1	pH units
Aldrin	8080	42-122	0 - 21	0.005	ppb
a-BHC	8080	37-134	0 - 24	0.003	ppb
b-BHC	8080	17-147	0 - 32	0.007	ppb
d-BHC	8080	19-140	0 - 36	0.007	ppb
g-BHC	8080	32-127	0 - 23	0.003	ppb
Chlordane	8080	45-119	0 - 20	0.200	ppb
4, 4-DDD	8080	31-141	0 - 28	0.006	ppb
4, 4-DDE	8080	30-145	0 - 28	0.010	ppb
4, 4-DDT	8080	25-160	0 - 36	0.007	ppb
Dieldrin	8080	36-146	0 - 38	0.006	ppb
Endosulfan I	8080	45-153	0 - 25	0.007	ppb
Endosulfan II	8080	1-202	0 - 61	0.008	ppb
Endosulfan sulfate	8080	26-144	0 - 27	0.008	ppb
Endrin	8080	30-147	0 - 37	0.008	ppb
Endrin Aldehyde	8080	30-147	0 - 37	0.017	ppb
Heptachlor	8080	34-111	0 - 20	0.009	ppb
Heptachlor epoxide	8080	37-142	0 - 21	0.005	ppb
Methoxychlor	8080	60-120	0 - 30	0.176	ppb
Toxaphene	8080	41-126	0 - 25	0.270	ppb
PCB 1016	8080	50-114	0 - 20	0.360	ppb
PCB 1221	8080	15-178	0 - 49	0.250	ppb
PCB 1232	8080	10-215	0 - 36	0.220	ppb
PCB 1242	8080	39-150	0 - 24	0.310	ppb

PCB 1248	8080	38-158	0 - 32	0.150	ppb
PCB 1254	8080	29-131	0 - 28	0.280	ppb
PCB 1260	8080	8-127	0 - 21	0.130	ppb
2, 4-D	8150	60-110	0 - 15	0.071	ppb
2, 4, 5-TP	8150	65-113	0 - 20	0.005	ppb
Aluminum	6010	90-110	0 - 1.90	0.014	ppm
Antimony	7041	90-110	0 - 3.63	0.010	ppm
Arsenic	7060	85-115	0 - 8.72	0.004	ppm
Barium	6010	90-110	0 - 2.38	0.002	ppm
Beryllium	6010	90-110	0 - 2.38	0.001	ppm
Cadmium	7131	93-107	0 - 2.51	0.0005	ppm
Calcium	6010	90-110	0 - 1.09	0.008	ppm
Chromium	7191	90-110	0 - 4.07	0.005	ppm
Cobalt	6010	90-110	0 - 2.41	0.005	ppm
Copper	6010	90-110	0 - 6.16	0.004	ppm
Iron	6010	90-110	0 - 5.10	0.005	ppm
Lead	7321	90-110	0 - 6.73	0.003	ppm
Magnesium	6010	90-110	0 - 3.22	0.015	ppm
Manganese	6010	90-110	0 - 2.64	0.005	ppm
Molybdenium	6010	90-110	0 - 3.50	0.015	ppm
Mercury	7470	95-105	0 - 5.78	0.0002	ppm
Nickel	6010	90-110	0 - 3.98	0.007	ppm
Potassium	6010	90-110	0 - 4.72	0.044	ppm
Selenium	7740	95-105	0 - 10.3	0.004	ppm
Silver	7761	85-115	0 - 4.28	0.001	ppm
Sodium	6010	90-110	0 - 6.02	0.015	ppm
Thallium	7841	95-105	0 - 5.23	0.005	ppm
Vanadium	6010	90-110	0 - 2.08	1.2	ppb
Zinc	6010	95-105	0 - 1.47	1.5	ppb
Acenapthene	8270	60-132	0 - 27.6	1.9	ppb
Acenapthylene	8270	54-126	0 - 40.2	3.3	ppb
Anthracene	8270	43-118	0 - 32.0	8.4	ppb
Benzo(a)anthracene	8270	42-133	0 - 27.6	3.3	ppb
Benzo(b)fluor anthene	8270	42-140	0 - 38.8	8.4	ppb
Benzo(k)fluor anthene	8270	25-146	0 - 32.3	6.1	ppb
Benzo(a)pyrene	8270	32-148	0 - 39.0	9.7	ppb
Benzo(ghi)perylene	8270	10-195	0 - 58.9	16.7	ppb

Butylbenzl phthalate	8270	10-140	0 - 23.4	9.1	ppb
Bis(2-chloroethyl)ether	8270	43-126	0 - 55.0	1.8	ppb
Bis(2-choroethoxy) methane	8270	49-165	0 - 34.5	1.5	ppb
Bis(2-chloroisopropyl) ether	8270	63-139	0 - 46.3	3.0	ppb
Bis(2-ehtylhexyl) phthalate	8270	29-137	0 - 41.1	13.1	ppb
4-Bromophenyl-phenylether	8270	65-114	0 - 23.0	1.2	ppb
2-Chloronapthalene	8270	65-114	0 - 13.0	8.0	ppb
4-Chlorophenyl-phenyleylether	8270	38-145	0 - 23.0	2.5	ppb
Chrysene	8270	44-140	0 - 48.3	2.6	ppb
Dibenzo(ah) anthracene	8270	10-200	0 - 70.0	6.0	ppb
Di-n-butyl phthalate	8270	10-111	0 - 16.7	9.8	ppb
1,2-Dichloro-benzene	8270	49-112	0 - 30.9	1.0	ppb
1,3- Dichloro-benzene	8270	17-154	0 - 41.7	1.6	ppb
1,4-Dichloro-benzene	8270	37-106	0 - 32.1	1.0	ppb
3,3-Dichloro-benzene	8270	8-213	0 - 70.0	15.0	ppb
Diethylphthalate	8270	10-100	0 - 26.5	11.5	ppb
Dimethylphthalate	8270	10-100	0 - 23.2	3.3	ppb
2,4-Dinitrotoluene	8270	48-127	0 - 21.8	11.2	ppb
2,6-Dinitrotoluene	8270	68-137	0 - 29.6	2.7	ppb
Di-n-octyl phthalate	8270	19-132	0 - 31.4	5.9	ppb
Fluoranthene	8270	43-121	0 - 32.8	4.3	ppb
Fluorene	8270	72-108	0 - 20.7	7.4	ppb
Hexachlorobenzene	8270	10-141	0 - 24.9	5.0	ppb
Hexachloro-butadiene	8270	38-102	0 - 26.3	4.4	ppb
Hexochlorocyclo-pentadiene	8270	10-141	0 - 50.0	5.0	ppb
Hexachoroethane	8270	55-100	0 - 24.5	1.0	ppb
Indeno(123-cd)-pyrene	8270	10-150	0 - 44.6	10.2	ppb

Isophorone	8270	47-180	0 - 63.3	4.1	ppb
Napthalene	8270	36-120	0 - 30.1	1.5	ppb
Nitrobenznene	8270	54-158	0 - 39.3	4.5	ppb
Nitroso-di-N-propylamine	8270	14-198	0 - 55.4	3.0	ppb
Phenathrene	8270	65-109	0 - 20.6	1.6	ppb
Pyrene	8270	70-125	0 - 25.2	6.6	ppb
1,2,4-Trichloro benzene	8270	57-129	0 - 28.1	2.9	ppb
4-Chloro-3-methyl-phenol	8270	41-128	0 - 37.2	3.8	ppb
2-Chlorophenol	8270	36-120	0 - 28.7	1.8	ppb
2,4-Dichlorophenol	8270	53-122	0 - 26.4	2.7	ppb
2,4-Dimethylphenol	8270	42-109	0 - 26.1	1.7	ppb
2,4-Dinitrophenol	8270	10-173	0 - 49.8	10.4	ppb
2-Methyldinitro-phenol	8270	53-100	0 - 50.0	12.0	ppb
2-Nitrophenol	8270	45-167	0 - 35.2	2.5	ppb
4-Nitrophenol	8270	13-107	0 - 47.2	20.4	ppb
Pentachlorophenol	8270	38-152	0 - 48.9	4.5	ppb
Phenol	8270	17-100	0 - 22.6	2.5	ppb
2,4,6-Trichloro-phenol	8270	52-129	0 - 31.7	3.7	ppb
Benzene	8240	76-130	0 - 6.9	1.56	ppb
Bromodichloro-methane	8240	66-130	0 - 6.4	2.29	ppb
Bromoform	8240	71-124	0 - 5.4	2.38	ppb
Bromomethane	8240	50-125	0 - 17.9	2.84	ppb
Carbontetra-chloride	8240	86-117	0 - 5.2	2.20	ppb
Chlorobenzene	8240	82-134	0 - 6.3	1.56	ppb
Chloroform	8240	69-121	0 - 6.1	1.42	ppb
Chloromethane	8240	60-130	0 - 19.8	6.16	ppb
Dibromochloro-methane	8240	69-133	0 - 6.1	1.56	ppb
1,1-Dichloroethane	8240	73-128	0 - 5.1	1.42	ppb
1,2-Dichloroethane	8240	71-132	0 - 6.0	1.42	ppb
1,1-Dichloroethene	8240	51-150	0 - 9.1	1.56	ppb
t-1,2-Dichloro-ethene	8240	70-131	0 - 5.7	1.10	ppb
1,2-Dichloro-propane	8240	34-166	0 - 13.8	1.68	ppb

c-1,3-Dichloro-propene	8240	25-150	0 - 15.8	2.20	ppb
t-1,3Dichloro-propene	8240	50-150	0 - 10.4	2.77	ppb
Ethylbenzene	8240	87-134	0 - 7.5	1.42	ppb
Methylene Chloride	8240	61-140	0 - 7.4	2.77	ppb
1,1,2,2-Tetra-chloroethane	8240	68-136	0 - 7.4	2.62	ppb
Tetrachloroethene	8240	85-133	0 - 5.0	2.01	ppb
Toluene	8240	83-125	0 - 4.8	1.10	ppb
1,1,1-Trichloro-ethane	8240	75-125	0 - 4.6	2.20	ppb
1,1,2-Trichloro-ethane	8240	71-129	0 - 5.5	2.20	ppb
Trichloroethene	8240	93-134	0 - 6.6	2.01	ppb
Trichlorofluoro-methane	8240	48-152	0 - 10.0	1.68	ppb
Vinyl Chloride	8240	50-150	0 - 20.0	2.84	ppb
Xylene	8240	75-125	0 - 5.0	1.56	ppb

TABLE 5-6

QUALITY ASSURANCE OBJECTIVES

SURFACE WATER, WASTE WATER

ANALYTE	METHOD	ACCURACY	PRECISION	MDL	
Alkalinity	310.1	85-120	0 - 5	3.80	mg/l
Conductrance	120.1	90-110	0 - 2	0.03	uMHOS/cm
Hardness	130.2	83-117	0 - 15	4.02	mg/l $CaCO_3$
Chloride	300	85-105	0 - 3	0.18	mg/l
Dissolved solids	160.2	80-120	0 - 10	29.0	mg/l
Fluoride	300	94-110	0 - 3	0.15	mg/l
Sulfate	300	96-105	0 - 3	1.50	mg/l
Nitrate N	300	97-103	0 - 3	0.05	mg/l
Ammonia N	350.3	92-108	0 - 10	0.09	mg/l
TKN	351.4	92-108	0 - 10	0.08	mg/l
Phosphorus, total	365.2	95-105	0 - 3	0.03	mg/l
COD	410.4	90-110	0 - 10	12.0	mg/l
Cyanide	335.3	94-106	0 - 5	0.01	mg/l
Suspended solids	160.1	80-120	0 - 10	10.6	mg/l
Phenolics	420.1	85-115	0 - 5	0.02	ppm
pH	150.1	98-102	0 - 1	0.1	pH units
Aldrin	608	81-97	0 - 8	0.005	ug/l
a-BHC	608	83-95	0 - 6	0.003	ug/l
b-BHC	608	84-92	0 - 4	0.007	ug/l
d-BHC	608	76-96	0 - 10	0.007	ug/l
g-BHC	608	87-107	0 - 10	0.003	ug/l
Chlordane	608	81-105	0 - 12	0.200	ug/l
4,4-DDD	608	86-98	0 - 6	0.006	ug/l
4,4-DDE	608	81-96	0 - 7	0.010	ug/l
4,4-DDT	608	82-102	0 - 10	0.007	ug/l
Dieldrin	608	86-104	0 - 9	0.006	ug/l
Endosulfan I	608	87-105	0 - 9	0.007	ug/l
Endosulfan II	608	90-105	0 - 7	0.008	ug/l
Endosulfan sulfate	608	87-109	0 - 12	0.008	ug/l
Endrin	608	89-101	0 - 6	0.008	ug/l
Endrin Aldehyde	608	81-93	0 - 6	0.017	ug/l

Heptachlor	608	78-98	0 - 10	0.009	ug/l
Heptachlor epoxide	608	88-98	0 - 5	0.005	ug/l
Toxaphene	608	84-106	0 - 11	0 360	ug/l
PCB 1016	608	88-100	0 - 6	0.250	ug/l
PCB 1221	608	83-109	0 - 13	0.220	ug/l
PCB 1232	608	81-95	0 - 7	0.220	ug/l
PCB 1242	608	86-98	0 - 6	0.310	ug/l
PCB 1248	608	85-95	0 - 5	0.150	ug/l
PCB 1254	608	82-102	0 - 10	0.280	ug/l
PCB 1260	608	74-108	0 - 17	0.130	ug/l
2,4-D	615	60-110	0 - 20	0.071	ug/l
2,4,5-TP	615	65-113	0 - 20	0.005	ug/l
Aluminum	200.7	90-110	0 - 1.90	14.0	ug/l
Antimony	204.2	90-110	0 - 3.63	10.0	ug/l
Arsenic	206.2	85-115	0 - 8.72	4.0	ug/l
Barium	200.7	90-110	0 - 2.38	2.0	ug/l
Beryllium	200.7	90-110	0 - 2.38	1.0	ug/l
Cadmium	213.1	93-107	0 - 2.51	0.5	ug/l
Calcium	200.7	90-110	0 - 1.09	8.0	ug/l
Chromium	218.2	90-110	0 - 4.07	5.0	ug/l
Cobalt	200.7	90-110	0 - 2.41	5.0	ug/l
Copper	200.7	90-110	0 - 6.16	4.0	ug/l
Iron	200.7	90-110	0 - 5.10	5.0	ug/l
Lead	239.2	90-110	0 - 6.73	3.0	ug/l
Magnesium	200.7	90-110	0 - 3.22	15.0	ug/l
Manganese	200.7	90-110	0 - 2.64	5.0	ug/l
Molybdenium	200.7	90-110	0 - 3.50	15.0	ug/l
Mercury	245.2	95-105	0 - 5.78	0.1	ug/l
Nickel	200.7	90-110	0 - 3.99	7.0	ug/l
Potassium	200.7	90-110	0 - 4.72	44.0	ug/l
Selenium	270.2	95-105	0 - 10.3	4.0	ug/l
Silver	272.2	85-115	0 - 4.28	1.0	ug/l
Sodium	200.7	90-110	0 - 6.03	15.0	ug/l
Thallium	279.2	95-105	0 - 5.23	5.0	ug/l
Vanadium	200.7	90-110	0 - 2.08	10.0	ug/l
Zinc	200.7	95-105	0 - 1.47	5.0	ug/l
Acenapthene	625	60-132	0 - 27.6	1.2	ug/l
Acenapthylene	625	54-126	0 - 40.2	1.5	ug/l
Anthracene	625	43-118	0 - 32.0	1.9	ug/l
Benzo(a)anthracene	625	42-133	0 - 27.6	3.3	ug/l

Benzo(b)fluor anthene	625	42-140	0 - 38.8	8.4	ug/l
Benzo(k)fluor anthene	625	25-146	0 - 32.3	6.1	ug/l
Benzo(ghi)perylene	625	10-195	0 - 58.9	16.7	ug/l
Butylbenzl phthalate	625	10-140	0 - 23.4	9.1	ug/l
Bis(2-chloroethyl)ether	625	43-126	0 - 55.0	1.8	ug/l
Bis(2-choroethoxy) methane	625	49-165	0 - 34.5	1.5	ug/l
Bis(2-chloroisopropyl) ether	625	63-139	0 - 46.3	3.0	ug/l
Bis(2-ehtylhexyl) phthalate	625	29-137	0 - 41.1	13.1	ug/l
4-Bromophenyl-phenylether	625	65-114	0 - 23.0	1.2	ug/l
2-Chloronapthalene	625	65-114	0 - 13.0	8.0	ug/l
4-Chlorophenyl-phenylether	625	38-145	0 - 23.0	2.5	ug/l
Chrysene	625	44-140	0 - 48.3	2.6	ug/l
Dibenzo(ah) anthracene	625	10-200	0 - 70.0	6.0	ug/l
Di-n-butyl phthalate	625	10-111	0 - 16.7	9.8	ug/l
1,2-Dichlorobenzene	625	49-112	0 - 30.9	1.0	ug/l
1,3-Dichlorobenzene	625	17-154	0 - 41.7	1.6	ug/l
1,4-Dichlorobenzene	625	37-106	0 - 32.1	1.0	ug/l
3,3-Dichloro benzidine	625	8-213	0 - 70.0	15.0	ug/l
Diethylphthalate	625	10-100	0 - 26.5	11.5	ug/l
Dimethylphthalate	625	10-100	0 - 23.2	3.3	ug/l
2,4-Dinitrotoluene	625	48-127	0 - 21.8	11.2	ug/l
2,6-Dinitrotoluene	625	68-137	0 - 29.6	2.7	ug/l
Di-n-octyl phthalate	625	19-132	0 - 31.4	5.9	ug/l
Fluoranthene	625	42-121	0 - 32.8	4.3	ug/l
Fluorene	625	72-108	0 - 20.7	7.4	ug/l
Hexachlorobenzene	625	10-141	0 - 24.9	5.0	ug/l
Hexachloro butadiene	625	38-102	0 - 26.3	4.4	ug/l
Hexochlorocyclo pentadiene	625	10-141	0 - 50.0	5.0	ug/l
Hexachoroethane	625	55-100	0 - 24.5	1.0	ug/l
Indeno(123-cd)pyrene	625	10-150	0 - 44.6	10.2	ug/l

Isophorone	625	47-180	0 - 63.3	4.1	ug/l
Napthalene	625	36-120	0 - 30.1	1.5	ug/l
Nitrobenznene	625	54-158	0 - 39.3	4.5	ug/l
Nitroso-di-N-propylamine	625	14-198	0 - 55.4	3.0	ug/l
Phenanthrene	625	65-109	0 - 20.6	1.6	ug/l
Pyrene	625	70-125	0 - 25.2	6.6	ug/l
1,2,4-Trichloro benzene	625	57-129	0 - 28.1	2.9	ug/l
4-Chloro-3-methyl phenol	625	41-128	0 - 37.2	3.8	ug/l
2-Chlorophenol	625	36-120	0 - 28.7	1.8	ug/l
2,4-Dichlorophenol	625	53-122	0 - 26.4	2.7	ug/l
2,4-Dimethylphenol	625	42-109	0 - 26.1	1.7	ug/l
2,4-Dinitrophenol	625	10-173	0 - 49.8	10.4	ug/l
2-Methyldinitro phenol	625	53-100	0 - 50.0	12.0	ug/l
2-Nitrophenol	625	45-167	0 - 35.2	2.5	ug/l
4-Nitrophenol	625	13-107	0 - 47.2	20.4	ug/l
Pentachlorophenol	625	38-152	0 - 48.9	4.5	ug/l
Phenol	625	17-100	0 - 22.6	2.5	ug/l
2,4,6-Trichloro phenol	625	52-129	0 - 31.7	3.7	ug/l
Benzene	624	76-130	0 - 6.9	1.56	ug/l
Bromodichloro methane	624	66-130	0 - 6.4	2.29	ug/l
Bromoform	624	71-124	0 - 5.4	2.38	ug/l
Bromomethane	624	50-125	0 - 17.9	2.84	ug/l
Carbontetra chloride	624	86-117	0 - 5.2	2.20	ug/l
Chlorobenzene	624	82-134	0 - 6.3	1.56	ug/l
Chloroform	624	69-121	0 - 6.1	1.42	ug/l
Chloromethane	624	60-130	0 - 19.8	6.16	ug/l
Dibromochloro methane	624	69-133	0 - 6.1	1.56	ug/l
1,1-Dichloroethane	624	73-128	0 - 5.1	1.42	ug/l
1,2-Dichloroethane	624	71-132	0 - 6.0	1.42	ug/l
1,1-Dichloroethene	624	51-150	0 - 9.1	1.56	ug/l
t-1,2-Dichloroethene	624	70-131	0 - 5.7	1.10	ug/l
1,2-Dichloropropane	624	34-166	0 - 13.8	1.68	ug/l
c-1,3-Dichloro propene	624	25-150	0 - 15.8	2.20	ug/l

t-1,3-Dichloro propene	624	50-150	0 - 10.4	2.77	ug/l
Ethylbenzene	624	87-134	0 - 7.5	1.42	ug/l
Methylene Chloride	624	61-140	0 - 7.4	2.77	ug/l
1,1,2,2,-Tetra chloroethane	624	68-136	0 - 7.4	2.62	ug/l
Tetrachloroethene	624	85-133	0 - 5.0	2.01	ug/l
Toluene	624	83-125	0 - 4.8	1.10	ug/l
1,1,1-Trichloroethane	624	75-125	0 - 4.6	2.20	ug/l
1,1,2-Trichloroethane	624	71-129	0 - 5.5	2.20	ug/l
Trichloroethene	624	93-134	0 - 6.6	2.01	ug/l
Trichlorofluoro methane	624	48-152	0 - 10.0	1.68	ug/l
Vinyl Chloride	624	50-150	0 - 20.0	2.84	ug/l
Xylene	624	75-125	0 - 5.0	1.56	ug/l

References:

Test Methods for evaluating Solid Waste, EPA SW-846, November 1986, Third Edition

Methods for Chemical Analysis of Water and Wastes, EPA-600 / 4-79-020 Revised March 1983

6.0 SAMPLING PROCEDURES

It is assumed that the data obtained from a sample is representative of the larger source from which it was collected. It is the responsibility of our clients to insure that samples are collected using procedures approved by the EPA; however, since our laboratory does provide sample containers, it is imperative that the containers and preservatives supplied do not compromise the integrity of the samples in any way.

6.1 SAMPLE BOTTLE PREPARATION

Table 6-1 describes the container and preservative required for each analysis. Preservatives shall not be added to the containers prior to shipping to the client but shall be transported in separate, secure containers. Bottles used for the collection of metals shall be rinsed with 50% reagent grade nitric acid two times followed by rinses with deionized water in triplicate. The bottles shall be tightly sealed for storage. Containers for organics shall be rinsed in triplicate with hexane and allowed to dry before being baked at 250 degrees centigrade for four hours. The bottles shall be capped while hot. Volatile organics shall only be collected in vials specially designed for VOA analysis. These vials shall be baked at 250 degrees centigrade for four hours and capped while still hot.

All preservatives shall be reagent grade chemicals. Metals shall be preserved with trace metal grade nitric acid.

TABLE 6-1

SAMPLE AND PRESERVATION REQUIREMENTS

PARAMETER	CONTAINER	VOLUME	PRESERVATION	HOLDING TIME
Acidity	P, G	50	cool	14 d
Alkalinity	P, G	50	cool	14 d
Ammonia Nitrogen	P, G	100	cool, pH<2 (S)	28 d
BOD	P, G	1000	cool	48 hr
COD	P, G	75	none	28 d
Chloride	P, G	50	cool	28 d
Chlorine, total	P, G	200	cool, pH<2 (S)	analyze immediately
Color	P, G	50	cool	48 hr
Cyanide	P, G	1000	cool, pH>12 (NaOH) 0.6 g ascorbic acid if free chlorine is present	14 d
Fluoride	P	300	none	28 d
Kjeldahl Nitrogen	P, G	500	cool, pH<2 (S)	28 d
Metals	P, G	200	pH<2 (N)	6 mo
Mercury	P, G	100	pH<2 (N)	26 d
Chromium VI	P, G	100	cool	24 hr
Nitrate	P, G	100	cool	48 hr
Nitrite	P, G	100	cool	48 hr
Oil and Grease	G	1000	cool, pH<2 (S)	28 d
Organic Carbon	P, G	50	cool, pH<2 (S)	28 d
Petroleum Hydrocarbon	G	1000	cool, pH<2 (S)	28 d
Phenols	G	500	cool, pH<2 (S)	28 d
Phosphorus	P, G	50	cool, pH<2 (S)	28 d
Solids, total	P, G	100	cool	7 d
Solids, suspended	P, G	100	cool	48 hr
Solids, dissolved	P, G	250	cool	7 d
Solids, settleable	P, G	1000	cool	48 hr
Solids, Volatile	P, G	100	cool	7 d
Conductivity	P, G	100	cool	28 d
Sulfate	P, G	100	cool	28 d
Sulfide	P, G	500	ZnAc + NaOH pH>9	7 d

Turbidity	P, G	100		cool	48 hr
Volatile Organics	VOA vial	50	cool,	HCL	14 d
Phenols	G	1000	cool,	0.008% SBS	7 d extract 40 d after ext
PCB's	G	1000		cool	7 d extract
Extractables (org)	G	1000	cool,	0.008% SBS	7 d extract 40 d after ext
Pesticides	G	1000	cool,	pH 5-9	7 d extract 40 d after ext
Alpha / Beta, Radium	G	1000		pH<2 (N)	6 mo

TABLE 6-1 APPENDAGE

P	Plastic Container
G	Brown Glass Container with Teflon Lined Cap
SBS	Sodium Bisulfite
S	Sulfuric Acid
N	Nitric Acid

7.0 SAMPLE CUSTODY

There is a joint responsibility between the client's sampling team and the laboratory to insure that sample integrity is not violated from the time of collection, through transport, analysis, and storage.

7.1 CHAIN OF CUSTODY DOCUMENTS

A document is required to certify that the sample has not been altered or contaminated. This document will detail the path the sample travels from the moment of collection to final disposal. This will determine the quality and integrity of the sample and will allow tracking of the person or persons involved in the collection, transport, analysis, and disposal of the sample.

A sample is said to be in the possession of an individual if:

1. It is in the actual physical possession of that person.

2. It is in the view of that person after that person has had it in his physical possession.

3. It is secured in a restricted area.

4. It is locked in such a way that no one can tamper with it after having it in his possession.

All samples received by the laboratory should have a completed chain of custody with them. If the analysis is to be performed to show regulatory compliance or is to be reported to any regulatory agency, the sample(s) must have a chain of custody associated with them. Shown in figure 7-1, the form should be completed as follows:

1. Each client should use pre-printed chain of custody forms supplied by the laboratory.

2. The client will be responsible for the completion of the sample description and analysis requested components of the form. Date and time of collection must be completed.

3. The person or persons collecting the sample(s) must insure that all samples are uniquely labeled with a field ID number and are clearly listed on the chain of custody sheets.

4. The person collecting the sample(s) begins the chain of custody by signing the block indicating that he was responsible for sample collection.

5. The sampler will sign the first "relinquished by" block when he transfers custody of the samples to the laboratory or courier.

6. The person transporting the samples will sign the "received block" and subsequently the "relinquished by" block as he transfers control.

7. This process continues until the samples reach the laboratory accessioning department where the appointed individual will sign the "received by laboratory" section. All samples are received by accessioning personnel and are under the supervision of the sample control officer of the laboratory.

8. The accessioning department will compare the samples to the chain of custody and initiate the in-house chain of custody forms. If there are discrepancies between the chain of custody and the samples received, the client will be notified immediately. Any notes concerning the disposition of the samples will be made on the chain of custody and initialed by the accessioning individual.

9. If samples are transported by commercial carrier, the samples and chain of custody should be sealed in a shipping container with the chain of custody forms protected from water using plastic bags.

10. A copy of the chain of custody should be given to the client and the original should be filed with the project data.

11. The samples are now the responsibility of the traffic control officer who is responsible for maintaining the security of stored samples.

7.2 ACCESSIONING

The process of logging samples into the laboratory analytical system is critical to the proper analysis of the samples. This process involves the following steps:

1. The integrity of each sample must be determined by comparing sample labels or tags with the chain of custody and by visual checks of the container for breakage. Any observed problems are noted on the chain of custody and laboratory log book.

2. Samples requiring acid or base preservation shall be checked with pH paper to determine the effectiveness of the preservative. If the pH is not within the prescribed range, a note of that must be made on the chain of custody and log book.

3. Attention should be given to sampling times and dates. These dates must be recorded in the laboratory log book. If there are obvious problems with holding times, the client must be notified.

4. A unique laboratory number is assigned to each sample. The numbers are attached to the sample, the chain of custody, and the log book. This number will be used in the main computer system to identify and track the sample throughout the laboratory.

5. Samples logged into the laboratory by the accessioning department will have the following information recorded in the log book:

   a. Laboratory sample number
   b. Sample identification, i.e., field number
   c. Client
   d. Date and time collected
   e. Date and time received in the laboratory
   f. Person(s) collecting the samples
   g. Types and amounts of samples received
   h. Conditions of the samples received
   i. Control number (project number)
   j. Analysis requested
   k. Date disposed

6. Proper in-house tracking sheets and worksheets are completed and kept with the samples.

7. The samples are transferred to the proper storage facility.

7.3 SAMPLE STORAGE

There are three primary concerns associated with sample storage: temperature, holding times, and security.

Refer to table 6-1 for the proper storage temperature and holding times for various assays performed by the laboratory.

All storage facilities will be locked at all times. As a sample is removed by an authorized person, the in-house chain of custody form must be removed with the sample and properly completed. Once an area is finished with their portion of the analyses, it is returned to secure storage. If all analyses have been completed and the data reported, it is transferred to sample archives.

All extracts and digests of samples should be treated as the sample itself. The digests / extracts should be maintained in secured areas within the various analytical departments until the analysis is complete.

Samples are stored in archives for at least three months before disposal. The disposal of samples is documented in the log book to complete the record on each sample. The date and mode of disposal are recorded.

7.4 SAMPLE TRACKING

Samples are tracked within the laboratory using the main computer system. Work orders are entered into the lab system by the accessioning department. Worksheets and manual tracking sheets are generated at the time of entry. These sheets provide a permanent record of time of analysis, person performing the analysis, raw data, and final reported results.

The worksheet is filed with all raw data and instrument print-outs. Filing is by project number, and all data associated with a particular project is filed within a folder. These files are secured and are accessed only by approved personnel within the department.

Final results are entered into the lab computer system for report generation. All entries into the system requires an ID number. Once entered, the data may be viewed by any lab personnel, but may not be changed by anyone other than the Technical Director or the Quality Assurance officer.

7.5 COMPUTER SECURITY

The laboratory computer uses a password security system. All personnel have an identification number that must be entered each time the computer is accessed. This number is logged into the sample record if any data is ordered, answered, or modified. The following levels of security are observed:

1. Access to all computer files, including client, data, and library data bases.

2. Ability to enter and review data, generate worksheets, or order any analyses on samples. Ability to modify data is denied.

3. Review only - no data bases may be modified.

The Technical Director and Quality Assurance officer are assigned security level 1. Technical personnel are assigned security level 2. Clerical personnel are given security level 3.

Reports are generated each morning. Before data is reported to the client, each report is reviewed by all department heads, the Quality Assurance officer, and the Technical Director. Each level of review has a distinct purpose: the department head checks for errors in data entry or calculation, the Quality Assurance officer monitors quality control data that is printed with the data, and the

Technical Director monitors the overall data package to insure that data reported is consistent with all known aspects of the project and samples.

7.6 COMPUTER MAINTENANCE

The computer system is maintained under a service contract by Texas Instruments, Inc. All records of service are kept for review.

SPECIALIZED ASSAYS

2 4 0577

SAL-QC-REV 2/9
DATE: 2-25-92
SECTION: 7.0
PAGE: 6 of 6

300 12 th Ave., South
Nashville, Tennessee 37203
(615) 726-0177

REFERRING CLIENT

BILLING CONTROL NUMBER (FOR LAB USE ONLY)	PROJECT #	P.O. #

SAMPLERS *(Signature)*	PROJECT NAME

FOR LAB USE ONLY ACC #	SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	# OF CONT.	ANALYSES REQUESTED

Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Received for Laboratory by: *(Signature)*	Date/Time
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*	Remarks	
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*		
Relinquished by: *(Signature)*	Date/Time	Received by: *(Signature)*		

8.0 ANALYTICAL PROCEDURES

8.1 APPROVED METHODS

Whenever possible the laboratory will use methods developed or approved by the USEPA. Sample type, source, and the regulatory agency requiring the analysis will determine the specific method chosen. Refer to tables 5-1, 5-2, and 5-3 for a listing of methods currently in use by this laboratory.

Laboratory procedure manuals or "SOP's" must be developed to see that the EPA published methods are molded around our operation. The written protocol must contain all of the elements of the EPA method, including the following:

1. Method name and applicability
2. Reference
3. Collection procedures, e.g., preservatives, filtration, transport, etc...
4. Analytical techniques to be involved in the analysis
5. Storage requirements and holding times
6. Reagent and standard preparation
7. Instrument specifics, e.g., columns, temperatures, etc...
8. Expected instrumental response
9. Limitations of the procedure
10. Calibration frequency and techniques
11. Quality Control
12. Calculations

All laboratory methods are approved by the Technical Director and the Quality Assurance officer prior to being placed into service.

8.2 PURCHASING OF REAGENTS

The nature of the analytical laboratory demands that all materials used in any assay of other substances be of a known quality. The wide variety of materials and reagents available makes it necessary to specify the name, brand, and grade of materials needed. It will be the responsibility of the area supervisor to determine the qualities of the materials needed, find an acceptable vendor, and supply that information to the purchasing agent. It is the responsibility of the area supervisor to check each reagent batch to make sure the proper reagents have been received.

All MSDS sheets will be filed and kept available to the department in which the chemical is to be used. The health and safety aspects of the laboratory are under the supervision of the Quality Assurance officer.

All reagents should be dated when received, and should not be used past the expiration date if one is listed.

8.3 REAGENT REQUIREMENTS

There are many different grades of analytical reagents available to the analytical chemist. All methods in use in the laboratory will specify the grade reagent that must be used in the procedure or process. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure, and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure and associated reagents to assure their compatibility.

Reagents or working standards that are prepared in-house should be dated and initialized by the analyst making the reagent.

The following guidelines should be followed in the use of various reagents:

Trace Metals:

1. Standards should be prepared from analytical grade metals or salts and should be dissolved in laboratory grade water and preserved with an appropriate acid. Alternatively, the standards may be purchased from a vendor supplying AA quality standards and must be traceable to an NBS standard.

2. Fuels should be monitored to insure there is no increase in background from the contaminant's in the fuel.

3. Only "class A" volumetric glassware should be used in reagent and standard preparation.

Organic analyses:

1. Solvents used in the preparation or extraction of organic analytes should be of "pesticide grade" quality.

2. Standards must be prepared from analytical grade chemicals or purchased from vendors supplying standards traceable to the NBS.

Water analyses:

1. Water will be considered to be "laboratory grade" if it has been passed through a charcoal filter to remove organics and has a resistance greater than 10 megohms after passing through the reverse osmosis system.

2. The resistance of the water will be recorded each day. If the resistance falls below 10 megohms, the Quality Assurance director or the Technical Director must be notified.

3. Any contaminant's noted in the analytical determination of other analytes must be reported to the department supervisor.

8.4 REAGENT STORAGE

The manner in which reagents and chemicals are stored is important from both the aspect of safety and reagent integrity. Generally, the following guidelines should be followed:

1. Light sensitive reagents should be stored in brown glass bottles.

2. All organic reagents should be stored in a refrigerator or freezer.

3. Organic reference materials will be stored in a freezer.

4. Fresh solutions of working standards will be prepared from stock solutions and will be compared to the standard being replaced before placing it into service.

Table 8-1 gives specific storage instructions for reagents and chemicals used in the laboratory.

TABLE 8-1

STORAGE OF REAGENTS AND CHEMICALS

CHEMICAL	STORAGE REQUIREMENTS
Concentrated acids	1
Stock standards for metals	2
Working standards for trace metals	2
Stock materials for BNAE determination	3
Working solutions of BNAE standards	3
Stock chemicals for VOA standards	4
Working VOA solutions	4
Bulk dry reagent chemicals	5
Working solutions containing organic compounds	6
Working solutions containing only inorganics	7
Flammable solvents	8
Non-flammable solvents	9

STORAGE REQUIREMENT KEYS

1. Stored in the original containers in acid storage cabinets. The cabinets are placed in controlled environment storage rooms away from the main laboratory. Organic and inorganic acids are stored separately.

2. Stored at room temperature in the standards cabinet of the metals department.

3. Stored at temperatures below 0 degrees in freezers in the department.

4. Neat standards are stored at room temperature in the standard cabinet in the department. Stock and working solutions are stored in the freezer.

5. Bulk reagents are stored at room temperature in the reagent storage room of the laboratory.

6. Stored refrigerated at 2-8 degrees C in the departments.

7. Stored at room temperature in the department.

8. Stored in vented solvent cabinets in the prep lab.

9. Stored separate from the flammable solvents in vented cabinets in the prep lab.

8.5 GLASSWARE

All volumetric glassware will be "Class A." Pyrex glass should be used where possible. Thick-wall beakers should be used for sizes greater than 250 ml. Plasticware shall not be used for purposes other than storage of inorganic solutions.

8.6 CLEANING OF GLASSWARE

The proper technique for cleaning glassware is chosen depending upon the intended use of the glassware being cleaned. The purpose of this is to remove all substances from the glassware that might interfere with the analysis. Water soluble substances can be removed with tap water followed with at least three rinses of laboratory grade water. In some instances detergent may be required. Detergent washings should be followed by three rinses with laboratory grade water. Specific guide lines are:

Organic glassware:

1. Rinse the glassware one time with acetone and one time with methylene chloride.

2. Wash the glassware with hot detergent water. A brush should be used to insure that all areas of the glassware have been thoroughly exposed to the detergent.

3. Rinse five times with tap water followed by three rinsings with laboratory grade water.

4. Dry the outside of the glassware with a towel.

5. Rinse the inside of the glassware with acetone two times and with methylene chloride two times.

6. If visual inspection indicates remaining contamination, rinse the glassware in concentrated sulfuric acid and then repeat steps two through five. If the contamination remains, discard the item.

7. If the glassware is to be used in the volatile organic area, it should be heated to 250 degrees for two hours, capped, and stored.

Inorganic glassware:

1. Wash the glassware in hot soapy water making sure all surfaces are covered.

2. Rinse at least five times with tap water and three times with laboratory grade water.

3. For trace metal analysis, rinse a final time with nitric acid followed by triplicate washings with laboratory grade water.

Glassware storage:

1. Once cleaned, glassware should be capped or covered for storage in a cabinet. Volatile organics glassware must be sealed.

2. Glassware is stored away from any bulk chemicals or reagents.

8.7 WASTE DISPOSAL

The final disposition of all wastes and samples is the responsibility of the Quality Assurance director. He is responsible for scheduling waste removals by the waste contractor and for keeping records of types, amounts, and times of disposal.

Organic Extraction Wastes

Waste organic solvent from organic extraction and glassware cleaning will be poured into drums labeled "WASTE ORGANIC SOLVENT". These drums are under the supervision of the Quality Assurance / Safety officer. When full, the drums will be removed by our contract hazardous waste disposal firm.

PCB Containing Wastes

Any organic solvent containing PCB's are segregated. Drums labeled "PCB CONTAINING SOLVENTS" are located in the solvent storage area for disposal of these wastes.

Sample Digests

All extracts are held in archives for three months before disposal. All extracts are combined and stored in approved waste containers prior to disposal by our contract hazardous waste disposal firm.

Samples

On a case by case basis, some samples will be returned to the client for disposal. If the samples are to be hazardous and there is greater than 50 grams of the material remaining following analysis, the sample should be marked as hazardous and stored with other archived samples. These hazardous wastes will be combined and removed by the hazardous waste disposal firm. Other samples, determined to be non-hazardous, may be disposed of as routine waste.

9.0 INSTRUMENT CALIBRATION

9.1 GENERAL OVERVIEW

Table 9-1 is a listing of our instrumentation used in the laboratory. All instruments used in the laboratory must be controlled with a formal calibration program. This program may be incorporated into the preventative maintenance program of the department. This program is necessary to demonstrate the equipment is operating within the proper range, precision, and accuracy required by the analysis intended.

Calibrations can be performed using reference standards, filters, etc., and may be performed by laboratory personnel or by the manufacturer's representative.

There are two types of calibration: operational and periodic. Operational calibration is performed as the instrument is used in an analysis and usually involves the development of response factors or curves relating to given amounts of standards. Periodic calibration should be performed on a prescribed time table and involves such actions as taking temperatures of ovens, baths, refrigerators, etc...

9.2 PERIODIC CALIBRATION

9.2.1 Procedures

Each instrument type will have a written procedure for periodic calibration. These procedures will address the following:

1. Instrument description, including model number
2. The standards used for calibration if applicable
3. Performance tolerances
4. Performance frequency. This should be at least that recommended by the manufacturer
5. Detailed procedure for calibration
6. Instructions for proper action in response to unacceptable calibration response

Additionally, associated with each individual instrument, there will be records of calibration which will include the following:

1. Instrument model and serial number

2. Standards used for calibration

3. Performance tolerances

4. Performance frequency

5. Results of the calibration, the initials of the individual making the calibration, and the date of the calibration

6. All records of calibration will be maintained in log books for easy access and review. Table 9-2 is a summary of equipment that requires periodic calibration.

9.3 OPERATIONAL CALIBRATION AND STANDARDIZATION

For the purposes of this manual, calibration will refer to the qualitative aspects of instrument performance, e.g., GC / MS tuning, ICP profiling, or UV / VIS Spectrometer wavelength verification. Standardization will refer to the development of a quantitative relationship between instrumental response and concentration of particular analytes. The frequency of calibration and standardization is addressed in the methods being applied to the instrument.

9.3.1 Operational Calibration

Table 9-3 summarizes laboratory instrumentation that requires calibration for proper performance.

9.3.1.1 GC / MS Tuning

In order to obtain spectra that are compatible with those obtained from other instruments, the instrument should be tuned to deliver the same spectrum, both in mass numbers and intensities from a given compound. The compound used to establish the abundance criteria for base / neutral / acid (BNA) compounds is decafluorotriphenylprophine (DFTPP). For volatile organics, the tuning compound is bromofluorobenzene (BFB). This calibration is required before standardization since calibration will directly influence standardization.

1. DFTPP. Each GC / MS unit should be calibrated every shift using 50 ng of DFTPP on column. The abundance criteria for DFTPP is listed in Table 9-4. The spectrum taken from the DFTPP injection should be filed in both bar graph and tabular formats.

2. BFB. Each GC / MS unit determining VOA's must be calibrated prior to each shift using a 50 ng injection of BFB. The tuning criteria for BFB is listed in Table 9-5. A bar graph and tabular listing of the ion abundance should be filed with all related data sheets.

9.3.1.2 ICP Profiling

The inductively coupled emission spectrometer must be profiled against a mercury lamp each day to determine wavelength accuracy.

9.3.2 Operational Standardization

Table 9-11 lists instrument standardization requirements.

9.3.2.1 Standards

All standards used in the laboratory must be tracked from the time of purchase or preparation through the analysis. Standards purchased from outside vendors must be traceable to the NBS, and certifying documentation must be filed in the department purchasing the standard. All stock standards are assigned a unique identification number and entered into the standard log book when prepared or purchased and placed into use. All intermediate and working standards prepared from the stock standards will be logged into the standard log book with the concentration of the diluted standard, the date, the name of the analyst preparing the standard, and the log number of the stock standard from which it was prepared. This working standard is prepared to replace it. Table 9-6 summarizes the standards routinely used in the laboratory, their source, storage requirements, and preparation.

9.3.2.2 GC / MS STANDARDIZATION

Following the calibration of the instrument using DFTPP or BFB, the instrument must be standardized against five concentrations of the analytes being determined to establish instrumental response over a specific concentration range.

1. Volatile organics must be standardized against solutions containing 20, 50, 100, 150, and 200 ug/l of all the compounds being analyzed. Additionally, three internal standards and three surrogate compounds are added immediately prior to analysis. Table 9-7 lists the internal standards and the volatile organic compounds to which they relate.

2. Semivolatile organics should be standardized against injections of 20, 50, 80, 120, and 160 ng of the compounds being determined. Nine compounds, benzoic acid, 2,4-dinitrophenol, 2,3,5-trichlorophenol, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4-nitrophenol, 4,6-dinitro-2-methylphenol and pentachlorophenol use a four point calibration at 50, 80, 120, and 160 ng. Six internal standards are used in semivolatile quantitation. Table 9-8 lists the semivolatile internal standards and the associated analytes.

The methods developed by the EPA specify the concentrations of the standards and the internal standards to be used in the quantitation of each compound. A response factor is calculated for each compound using the following equation:

$$R_F = \frac{A_x}{A_{IS}} \times \frac{C_{IS}}{C_x}$$

RF	=	response factor
Ax	=	area of the characteristic ion for the compound being determined
Ais	=	area of the characteristic ion for the internal standard specified
Cis	=	concentration of the internal standard (ng/ul)
Cx	=	concentration of the compound to be measured in ng/ ul

The calibration factor for all of the "calibration check compounds" (CCC's) listed in Table 9-9 must fall within certain prescribed limits for the standardization to be acceptable. The relative standard deviation (%RDS) must be calculated for all calibration check compounds.

$$\%RSD = \frac{Ó}{X} \times 100$$

RSD	=	relative standard deviation
Ó	=	standard deviation of initial five response factors per compound
X	=	mean of initial five response factors per compound

The %RSD must be less than 30% for all CCC's in order to accept the calibration.

In addition to checking the statistics of the curve fit, the instrument response must be checked using the "system performance check" compounds (SPCC's). The GC / MS system must give a required minimum response to a given amount of standard injection for the calibration to be valid. Table 9-9 lists the volatile and semivolatile CCC's and SPCC's with the associated minimum value.

Once the five point calibration has been completed, a check of the validity of the calibration must be made using "continuing calibration" standard. This 50 ng standard is analyzed and compared to the original five point calibration curve, and it's analyzed value must be 25% of the expected value. If the continuing calibration standard does not meet the criteria of acceptability, the instrument must be evaluated, corrective action taken, and the standard repeated. No analysis may begin until a valid five point calibration curve is produced and the continuing standards meet specifications.

9.2.2.3 Standardization of the Gas Chromatograph

Before analysis using the gas chromatograph, a five point calibration curve must be run with the initial standard having a concentration near the detection limit of the analysis being performed. The response factors are calculated for each compound at each concentration level and these factors are averaged. The mean response factor is used to calculate concentrations of the compounds of interest. The %ESD must be less than 30% for these response factors. The continuing calibration standard must fall within 15% of the average response factor for the compounds being analyzed. If unknown samples exceed the range of the standard curve they must be diluted and reanalyzed.

9.2.2.4 Standardization of the ICP

The ICP is standardized by aspiring solutions containing the metals of interest. A calibration blank and one standard at 10.0 mg/l is sufficient for calibration. An independent calibration verification standard (ICV) and an "initial calibration blank" (ICB) are analyzed immediately following standardization. "Continuing calibration verification standards" (CCV) and "continuing calibration verification blanks" (CCB) will be analyzed after every ten samples and at the end of the analytical run. The CCB's must never exceed the instrument detection limit, and the CCV's must always fall within 10% of the true value. If either of these criteria are not met, the system must be considered out of calibration.

To assess the effects of inter-element interferences on selected element channels, an "interference check sample" (ICS) must be analyzed at the beginning and end of each analytical run. Table 9-10 lists the interferents and the affected elements along with the concentrations of each element in the (ICS). The assayed value of each of the affected elements must be within 20% of the true

requirements, a re-evaluation of the inter-element corrections factor is required.

The linearity of the ICP must be determined quarterly. This is accomplished by increasing the concentration of solutions being aspirated into the instrument until a 10% difference between the true value and the analyzed value is noted. That concentration is upper range of linearity for that channel.

9.2.2.5 Standardization of the Atomic Absorption Spectrometer

The atomic absorption spectrometer must be standardized with a blank and three standards for each analytical run. The curve fit for the calibration must exceed 0.995. The validity of the standard used for calibration must be shown by assaying an independent "initial calibration verification" standard (ICV) before any analyses are begun. This standard must fall within 10% of its true value to be within acceptable limits. The "initial calibration blank" (ICB) is run following standardization to demonstrate that the instrument is free of contamination. This blank must not exceed the instrument detection limit for this element. "Continuing calibration blanks" (CCB's) must be analyzed every ten samples. The CCV must fall within 10% of the expected value of the calibration or must be considered invalid.

TABLE 9-1

LABORATORY INSTRUMENTATION

Gas Chromatographs

2 Tracor 540 with Flame and PID and Tekmar / Purge / Trap
1 Tracor 540 with Flame and Hall and Tekmar / Purge / Trap
2 Perkin Elmer Autosystem with Flame
2 Varian 3700 with EC and Flame

HPLC

1 Shimadzu, Model SCL-6B, Dual Pump, UV and Fluorescence detectors

Spectrometer, GC / MS

1 Finnigan Model 5100 with Finnigan 9611 GC & Tekmar / Purge / Trap
1 Finnigan Incos 50 with HP 5890-II GC and Tekmar / Purge / Trap
2 Finnigan Incos 50 XLE with Varian 3400 GC
1 VG Trio-1 with Hewlett-Packard 5890-II GC

Spectrometer, ICP

1 Jarrell Ash ICP-9000 with Software Model 61E

Spectrometer, Atomic Absorption

1 Perkin Elmer Model 1100
1 Perkin Elmer Model 5100

Spectrometer UV / Visible

1 Shimadzu, Model 160U

Spectrometer, Infrared

1 Perkin Elmer, 1600 Series FTIR

Mercury Analyzer

1 Leeman Mercury Analyzer, Model PS-200

Specific Conductance

1 Orion Meter, Model 126
1 Markson, Model 10 Meter

Turbidimeter

1 HF Instruments, Model DRT-100B

pH Meters

1 Corning pH Meter, Model 220
1 Fisher Accumet pH Meter, Model 620
1 Orion pH Meter, Model 611

Ion Chromatograph

1 Dionex Ion Chromatograph

TOC Analyzer

1 Shimadzu, Model 5050

TOX Analyzer

1 Dohrmann, Model MC-1 with AD-2 Concentrator

Fluorometer

1 Sequoia Turner, Model 450

Oxygen Calorimeter

1 The Parr Model

Integrators / Printers

3 Hitachi D-2500 Integrators
1 Seikosha Printer
1 Spectra Physics Model 4270 Integrator
5 P.E. Nelson, Model 1020 Printer / Plotter

Temperature Devices

6 Refrigerator / Freezers, Major Brands
2 BOD Incubators, Fisher 307
1 Evaporator, Thermolyne
1 Flash Tester, Pensky-Martens, ASTM D-39
1 COD Reactor, Hach
2 Water Circulators, Neslab CFT-33
2 Ovens, drying, MB-2729-Q
1 Oven, drying, Model Grieve 323
1 TKN Heater Digestor, LabConco 60011
1 Furnace, Fisher Model 186 A
1 Furnace, Thermolyne 1400

Centrifuge

2 Fisher Scientific, Model 228
1 Dynac Table Top
1 Clay Adams Table Top

Shakers

4 Eberback
4 Vortex Mixer, Fisher Brand

Ultra-Sonic Disruptors

4 Tekmar, Model TM-600-2
2 Heat Systems, Model W-380

Ultra-Sonic Bath

2 Fisher Model FS-28

Zero Head Space Extractors

12 Millipore Model

Zero Head Space Rotators

3 Millipore, 4-place capacity

TCLP Rotators

2 RO & JS Design, 12 place capacity

TABLE 9-2

PERIODIC CALIBRATION

INSTRUMENT	TYPE CALIBRATION	FREQUENCY
Analytical balances	Accuracy determined using certified "Class S" weights.	daily
Refrigerators	Temperature checked using calibrated thermometers.	daily
Spectrophotometers	Wavelength and absorbance accuracy using certified standard solutions.	six months
Conductivity meters	Cell impedance determination	monthly
Ovens	Temperature checked using calibrated thermometers.	monthly
GC/MS	Mass calibration	weekly

TABLE 9-3

OPERATIONAL CALIBRATIONS

INSTRUMENT	TYPE CALIBRATION	REQUIREMENTS	FREQUENCY
TOX Analyzer	Verification of silver titration cell	Titrated standard must fall within 5% of true value	each run
GC/MS	Mass assignment and abundance (tuning)	DFTPP for semivolatiles and BFB for volatiles must meet requirements in tables 9-4 and 9-5	every 12 hours
ICP	Wavelength accuracy	Mercury 253.7 line must be centered within a 0.2 nm window	daily

TABLE 9-4

DFTPP KEY IONS AND ABUNDANCE CRITERIA

MASS	ION ABUNDANCE
51	30-60% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	40-60% of mass 198
197	less than 1.0% of mass 198
198	base ion, 100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	greater than 1% of mass 198
441	present, but less than mass 443
442	greater than 40% of mass 198
443	17-23% of mass 442

TABLE 9-5

BFB KEY IONS AND ABUNDANCE CRITERIA

MASS	ION ABUNDANCE
50	15-40% of mass 95
75	30-60% of base peak
95	base peak, 100% relative abundance
96	5-9% of base peak
173	less than 1.0% of base peak
174	greater than 50% of base peak
175	5-9% of mass 174
176	greater than 95% but less than 101% of 174
177	5-9% of mass 176

TABLE 9-6

STANDARD SOURCES AND PREPARATION

INSTRUMENT	SOURCE	HOW RECEIVED	STORAGE	STOCK	STORAGE	FREQ
ICP	SPEX	1000 ppm Solutions	Room temp	Working standards are prepared at 0.5-20 ppm from stock	Room temp	daily
AA	Perkin-Elmer	1000 ppm Solutions	Room temp	Intermediate standards at 1.0 prepared from stock	Room temp	bi-monthly
				Working standards at 5-200 ppb prepared from intermediate standards	Room temp	daily
GC	Supelco/ Ultra	Solutions	0-4 deg.	Intermediate standards from stock	Room temp	monthly
				Working standards prepared from intermediate standards	Room temp	daily
TOX	Fisher	Solutions	0-4 deg.	Working standards prepared from stock	0-4 deg.	monthly
TOC	Fisher/ Dohrman	Solutions	0-4 deg.	Used as received	0-4 deg.	monthly
GC/MS	Supelco	1000 ppm Solutions	0-5 deg.	Working standards prepared from stock	0-4 deg.	monthly

TABLE 9-7

INTERNAL STANDARDS FOR VOLATILE ORGANICS

BROMOCHLOROMETHANE	1,4-DIFLUOROBENZENE	CHLOROBENZENE
Chloromethane	2-Butanone	2-Hexonone
Bromomethane	1,1,1-Trichloroethane	4-Methyl-2-pentanone
Vinyl Chloride	Carbon Tetrachloride	Tetrachlorethene
Chlororoethane	Vinyl Acetate	1,1,2,2_tetrachloroethane
Methyl Chloride	Bromodichloromethane	Toluene
Acetone	1,2-Dichloropropane	Chlorobenzene
Carbon Disulfide	t-1,3-Dichloropropene	Ethyl benzene
1,1,-Dichloroethene	Trichloroethane	Styrene
1,1-Dichloroethane	Dibromochloromethane	Xylene
t-1,2-Dichloroethene	1,1,2-Trichloroethane	Bromofluorobenzene
Chloroform	Benzene	Toluene-d8
1,2-Dichloroethane	c-1,3-Dichloropropene	
1,2-Dichloroethane-d4	2-Chloroethyl Vinyl Ether	
	Bromoform	

TABLE 9-8

INTERNAL STANDARDS FOR SEMIVOLATILE ORGANICS

1,4-DICHLOROBENZENE	NAPTHALENE-d8	ACENAPTHENE-d10
N-nitrosodimethylamine	Nitrobenzene	Hexachlorocyclopentadiene
Phenol	Isophorone	2,4,6-Trichlorophenol
Aniline	2-Nitrophenol	2,4,5-Trichlorophenol
Bis-2-chloroethyl ether	2,4-Dimethylphenol	2-Chloronapthalene
2-Chlorophenol	Benzoic acid	2-Notroanilinr
1,1-Dichlorobenzene	Bis-2-chloroethoxy methane	Dimethylphthalate
1,4-Dichlorobenzene	2,4-Dichlorophenol	Acenapthylene
Benzyl alcohol	1,2,4-Trichlorobenzene	3-Nitroaniline
1,2-Dichlorobenzene	Napthalene	Acenapthene
2-Methylphenol	4-Chloroaniline	2,4-Dinitrophenol
Bis-2-chloroisopropyl ether	Hexachlorobutadiene	4-Nitrophenol
Methylphenol	4-Chloroaniline	Dibenzofuran
N-nitroso-di-n-propyl ether	2-Methylnapthalene	2,4-Dinitritoluene
Hexachloroethane	Nitrobenzene-d5	2,6-Dinitrotoluene
2-Fluorophenol		Diethylphthalate
Phenol-d6		4-Chlorophenylphenyl ether
		Fluorene
		4-Nitroaniline
		2-Fluorobiphenyl
		2,4,6-Tribromophenol

PHENANTHRENE -10	CHRYSENE - d12	PERYLENE -d12
4,6-Dinitro-2-methylphenol	Benzidine	Di-n-octylphthalate
4-Nitrosodiphenylamine	Pyrene	Benzo(b)fluoranthene
1,2-Diphenylhydrazine	Butylbenzyphthalate	Benzo(k)fluoranthene
4-Bromophenylphenylrther	3,3-Dichlorobenzidine	Benzo(a)pyrene
Hexachlorobenzene	Benzo(a)anthracene	Idene(1,2,3-c,d) pyrene
Pentachlorophenol	Bis-2-ethylhexylphthalate	Dibenz(a,h)anthracene
Anthracene	Chrysene	Benzo(ghi) perylene
Di-n-butylphthalate	Terphenyl-d14	
Fluoranthene		

TABLE 9-9

CALIBRATION CHECK COMPOUNDS

BASE / NEUTRAL FRACTION	ACID FRACTION	VOLATILE FRACTION
Acenapthene	4-Chloro-2-methylphenol	1,2-Dichloroethene
1,4-Dichlorobenzene	2,4-Dichlorophenol	Chloroform
Hexachlorobutadiene	2-Nitrophenol	1,2-Dichloropropene
N-nitroso-di-n-phenylamine	Phenol	Toluene
Di-n-octylphthalate	Pentachlorophenol	Ethylbenzene
Benzo(a)pyrene	2,4,6-Trichlorophenol	Vinyl Chloride

SYSTEM PERFORMANCE CHECK COMPOUNDS

BASE/NEUTRAL FRACTION	MINIMUM RF
N-Nitroso-di-n-propylamine	0.05
Hexachlorocyclopentadiene	0.05

ACID FRACTION	MINIMUM RF
2,4-Dinitrophenol	0.05
4-Nitrophenol	0.05

VOLATILES	MINIMUM RF
Chloromethane	0.30
1,1-Dichloroethane	0.30
Bromoform	0.25
1,1,2,2-Tetrachloroethane	0.30
Chlorobenzene	0.30

TABLE 9-10

INTERFERENCE CHECK SAMPLE ELEMENT CONCENTRATIONS

SOLUTION A		SOLUTION B	
ANALYTES	MG/L	INTERFERENTS	MG/L
Ag	1.0		
Ba	0.5	Al	500
Be	0.5	Ca	500
Cd	1.0	Fe	200
Co	0.5	Mg	500
Cr	0.5		
Cu	0.5		
Mn	0.5		
Ni	1.0		
Pb	1.0		
V	0.5		
Zn	1.0		

TABLE 9-11

INSTRUMENT STANDARDIZATION

INSTRUMENT	SOURCE	# STDS INIT CAL	ACC / RJT CRITERIA	FREQ	# STDS CONT CAL	ACC / RJT CRITERIA	FREQ
GC: Pesticides	Supelco	5	R=>0.9995 linear	monthly or at failure of CCV	1	Must be within 15% of std curve	10%
PCB's	Supelco	5	R=>0.995 linear	monthly or at failure of CCV	1	Must be within 15% of std curve	10%
Herbicides	Supelco	5	R=>0.995	monthly or at failure of CCV	1	Must be within 15% of std curve	10%
TOX	Fisher	1	Must be within 3% of true value	each run	1	Must be within 5% of true value	10%
TOC	Fisher	3	R=>0.9990	each run	1	Must be within 5% of curve	10%
BOD	In-house	3	R=>0.995	each run	3		
Ion Chrom.	Dionex / Fisher	3	R->0.9995	When CCV fails to meet criteria	1	Must be within 5% of true value	10%
GC / MS: VOA's	Supelco	5	CCC's RSD < / = 30% SPCC's must have Rf's >0.30 (bromoform) Rf> / = 0.25	every six months or at failure of initial calibration	1	CCC's RSD must be < / - 25% SPCC's min resp factor 0.30 (Bromoform 0.25)	12 hr

BNA's	Supelco	5	CCC's RPD < / + 30% SPCC's min Rf is 0.050	every six months or at failure of init or continuing calibration	1	CCC's RSD must be < / + 25% SPCC's Rf must be min 0.050	12 hr
ICP	Spex	1	none	daily	1	Must be within 10% of true value	10%
AA	Perkin-Elmer	3	R=>0.995	each run	1	Must be within 10% of true value	10%
MSA	Perkin-Elmer	3	R=>0.995	each sample	n/a		

10.0 PREVENTIVE MAINTENANCE

Preventive maintenance is the action taken to maintain proper instrument function and performance, e.g., cleaning, adjustment, lubrication, etc. To be considered within the preventive maintenance program are:

1. Instrument manufacturers' suggested maintenance schedule.

2. Appropriate spare parts inventory.

3. Frequency and assignment preventive maintenance.

The department supervisor is responsible for the preventive maintenance of instruments within his department. Documentation of all maintenance, scheduled or unscheduled, will be kept for each instrument. Log books will be assigned to each instrument in which will be recorded the maintenance required, the frequency, date performed, and the name of the individual performing the maintenance. These records become part of the laboratory's permanent record.

Table 10-1 lists laboratory instrumentation and the required maintenance for each instrument.

10.1 CONTINGENCY PLANS

Even with redundant instrumentation, there are instrumental failures that require immediate action to prevent loss of irreplaceable samples due to holding time expiration. The following steps should be followed subsequent to any instrument failure:

1. Immediately notify the department supervisor. It is the supervisors responsibility to assess the severity of the failure and to estimate the expected down time.

2. If, in the judgement of the supervisor, the instrument will not be operational in time to perform the analyses scheduled on that instrument within the allowed time, the analyses will be shifted to other instrumentation if available.

3. If the repair is judged to be outside of the abilities of the laboratory personnel, the Technical Director is notified and a call is placed for manufacturers service.

4. The Technical Director is responsible for evaluating sample load and holding times. If, in his judgement, projects will be delayed, clients are immediately notified. If, in his judgement, the holding times for the samples will expire before analysis will be completed, the client is notified and arrangements are made to refer samples to another laboratory for analysis.

5. The traffic control officer must be kept apprised of the instrument failure in order to prevent scheduling of further analyses on that instrument.

TABLE 10-1

PREVENTIVE MAINTENANCE

INSTRUMENT	ACTIVITY	FREQUENCY
Gas Chromatography	change septum	daily
	check gases	daily
	repack column	as needed
	clean detector	as needed
	check autosampler seals	daily
	check flame gases	monthly
	clean injectors	as needed
	change PID lamp	as needed
HPLC	check seals and fittings for pressure leaks	each use
Spectrometer GC / MS	change septum on GC	daily
	bake trap	daily
	clean source	fails BFB / DFTPP
	change pump oil	3 months
	clean injector	SPCC failure
	replace injector liner	SPCC failure
	clip capillary column	SPCC failure
Spectrometer ICP	Torch inspection	daily
	Torch and nebulizer cleaned	as needed
	filters inspected	daily
	filters changed	as needed
	pump tubing inspected	daily
	pump tubing changed	as needed
Spectrometer Atomic Absorption	inspect graphite tube	daily
	inspect contact rings	daily
	clean windows	daily
	align lamp	daily
Spectrophotometer UV / VISIBLE	check paper	daily
	clean sample compartment	as needed

	auto-check calibration	daily at start up
	wavelength calibration	every 6 months
Spectrometer	change desiccant	as needed
Infrared	check chart paper	daily
Leeman Mercury	change drying tubes	daily
Analyzer	run aperture test	daily
	inspect tubes / reagents	daily
Conductivity	clean cell	each use
Meter	calibrate cell	yearly
Turbidimeter	Check lamp	each use
	clean sample holder	each use
pH Meter	clean electrode	each use
	inspect electrode	each use
Ion Chromatograph	check pressure	daily
	check elution reagent volume	daily
	replace pump seals	as needed
Shimadzu TOC	check gas flow	daily
Analyzer	check fluid level	daily
	replace "O" rings	monthly
	check needle	daily
	replace scrubbers	yearly
	replace catalyst	as needed
Dohrmann TOX	clean inlet tube	as needed
Analyzer	clean cell	monthly
Fluorometer	clean cells	each use
Oxygen	tighten connectors	each use
Calorimeter	calibrate thermometer	yearly

Integrators / Printers	Print clarity paper	daily daily
Temp. Devices Refrigerators Incubators, BOD Evaporators Flash Tester COD Reactor Water Circulators Ovens, Drying	temperature	daily or when used
Weighing Balances	clean pan calibrate	each use weekly
Centrifuge	clean replace brushes	as needed
Shakers	clean	when needed
Ultra-sonic Disrupters	clean	each use
Ultra-sonic Bath	clean, check, water level	daily
Zero Head Space Extractors	check rotations	yearly
Zero Head Space Rotators	check rotations	yearly
TCLP Rotators	check rotations	yearly

11.0 ASSESSMENT OF ACCURACY AND PRECISION

11.1 QUALITY CONTROL CHECK

The performance of all analytical methods must be monitored to assess the accuracy and reproducibility of the procedure. Specific quality control checks are designed to provide the necessary information for method assessment.

The basic quality control unit is the sample batch. A sample batch is defined as a group of samples of a similar matrix, analyzed in the same method sequence using the same lots of reagents, and the same sample treatment.

Quality control samples are defined below. Methods requiring various quality control samples, their purpose, and concentration level, are listed in Table 11-1.

11.1.1 Blanks

Blanks are artificial samples of an analytical matrix designed to detect the introduction of artifacts into the system.

11.1.1.1 Method blank

The method blank is prepared from an aliquot of analyte free matrix that is processed through the entire analytical process and is analyzed with the sample set. One method blank is analyzed per sample set or one in twenty samples whichever is more frequent.

11.1.1.2 Reagent blank

The analytical blank is prepared from laboratory grade water processed through the analytical system and analyzed with the sample set. The analytical blank may substitute for the method blank if an interference free matrix is not available.

11.1.2 Spiked samples

Samples fortified to a known and validated concentration of all analytes being determined are termed matrix spikes. The relationship between the known concentration and the analyzed value is the percent recovery. Where sufficient sample is available, a matrix spike (and duplicate where required), is analyzed in each sample set or one sample in twenty, whichever is more frequent.

11.1.2.1 Reagent spikes

Reagent spikes are prepared by fortifying an analyte-free matrix with analytes prior to preparation.

11.1.2.2 Matrix spikes

Matrix spikes are prepared by fortifying a sample chosen from the sample set with all analytes being determined.

11.1.2.3 Surrogate spikes

Compounds having similar chemical characteristics to those being analyzed, but which are not generally found in environmental samples, are used as surrogate compounds. Known concentrations of these compounds are added to all samples in the set prior to sample preparation.

11.1.3 Quality Control checks

Samples or standards from an independent source used to verify calibration, standardization, and procedural accuracy and precision are quality control samples.

11.1.3.1 Calibration verification standards

Standard solutions from a source other than the source of the original standardization materials are used to verify standardization.

11.1.3.2 Quality control check samples

Samples obtained from an independent source for which the concentrations of the analytes have been validated are termed quality control check samples. These samples are introduced into the analytical stream by the QA officer and are analyzed as "blind" samples. These samples are analyzed semi-annually.

11.1.3.3 Laboratory control samples

Samples obtained from an independent source for which the concentrations of the analytes have been established are used as laboratory control samples. These samples are introduced into the analytical stream by the sample preparation laboratory and are analyzed with each sample set.

11.2.3 Duplicates

In order to assess procedural precision, two aliquots of the same sample are prepared and analyzed at the same time. Some procedures require the sample to be split and spiked in duplicate, as in 11.1.2.2. Duplicates are assayed with each sample set or one in twenty samples.

11.2 ROUTINE METHODS TO ASSESS PRECISION AND ACCURACY

Accuracy and precision of laboratory methods are assessed by statistically analyzing the data from matrix spike and duplicate analyses. Table 11-1 specifies the procedures and concentrations used to develop accuracy and precision data.

11.2.1 Accuracy

The percent recovery of each matrix spike is calculated as:

$$\frac{ssr - sr}{sa} \times 100 = \text{percent recovery}$$

where:

ssr is spike sample concentration
sr is sample concentration
sa is spiked added concentration

When, at least, thirty samples have been analyzed, the mean percent recovery and the standard deviations are calculated:

$$\%Rm = \sum \frac{\%R \ldots \%Rn}{n}$$

$$S = \left[\sum \frac{\%Rn - \%Rm}{n - 1} \right]^{1/2}$$

where:

%Rm = mean percent recovery
%Rn = the percent recovery of a single pair
n = the number of results
S = the standard deviation of the data set percentage recovery

The accuracy of the method is expressed as the target mean and + / - two standard deviations from the mean. Quality control data is entered into the laboratory computer where it is tabulated and a running mean and acceptance range is calculated. The most recent 50 data points, including those outside QC limits are used to calculate statistics.

Quality control charts are accessible through the computer and are updated upon each entry of data. The acceptable range of a calculated recovery data point may be determined by comparing the value to the mean + / - two standard deviations listed on the chart. These charts are printed monthly and reviewed by the QA director for trends or other QC anomalies.

11.2.2 Precision

Precision is accessed by the statistical analysis of data from duplicate analyses:

$$\%RPD = \frac{D1 - D2}{(D1 - D2)/2} \times 100$$

When, at least thirty sample have been analyzed the mean and standard deviation is calculated:

$$M = \frac{m1 \ldots mn}{n}$$

$$Sm = \left[\frac{(m - M)^2}{n-1} \right]^{1/2}$$

where:

m = the RPD of a replicate pair
M = the average of the RPD determinations
Sm = the standard deviation of the data set of RPD determinations
n = the number of determinations

the acceptable range for precision is the mean + / - two standard deviations. Quality control charts are generated by the computer and reviewed by the QA officer monthly. The mean and standard deviation is calculated after each data point is entered.

11.3 METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS

11.3.1 Method detection limits

The method detection limit is the smallest concentration of analyte that can be measured and reported with 99 percent confidence that the concentration is greater than zero. MDL's are determined by the procedure outlined in Appendix B of 40 CFR, part 136.

Laboratory grade water is fortified with analytes at a concentration 1-5 times the estimate method detection limit. Seven aliquots of the sample is taken through the entire analytical process. The variance and standard deviation of the replicate measurements are determined a follows:

$$S_2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \left[\sum_{i=1}^{n} x_i\right]^2 / n\right]$$

where: X_i; i=1 to n, are the analytical results in the final reporting units obtained from the n sample aliquots and refers to the sum of the X values from i = 1 to n.

The MDL is computed by multiplying the standard deviation by the student's "t" value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom and the "t" value at 99 percent confidence level would be 3.143, using seven replicates.

The MDL's are verified and updated semi-annually.

11.3.2 Practical quantitation limit

The practical quantitation limit is the smallest concentration of analyte that can be reported with some degree of confidence. PQL's are generated from the same data set used to determine MDL's. The PQL is derived by multiplying by 10 the standard deviation determined in 11.3.1. This corresponds to an uncertainty of + / - 30 percent in the measured value at the 99 percent confidence level. PQL's are verified and updated annually.

TABLE 11-1

QUALITY ASSURANCE TARGETS

Methods Used To Generate Precision and Accuracy Targets

METHODS	PURPOSE	CONC. LEVEL	METHOD REFERENCES
Duplicates	Precision	Mid Level	All 200 and 7000 series AA methods. 200.7 and 6010 for ICP
Duplicate matrix spikes	Precision and accuracy	Mid Level	600 series organics 8000 series organics 300 and 900 series anions 330.5 and 9010 cyanide 9020 TOX 376.1 and 9030 sulfide 415.1 and 9060 TOC 420.1 and 9065 phenols
Matrix spikes	Accuracy	Low Level Mid Level	All AA furnace metals ICP metals
Laboratory control samples	Accuracy	Mid Level	All AA and ICP metals

12.0 DATA REDUCTION, VALIDATION, AND REPORTING

12.1 DATA REDUCTION

It is the responsibility of the analyst to perform the procedures strictly according to the written protocols. This includes the analysis of the proper QC materials, standards, and blanks. The analyst is further responsible for the computation of the final result and the recording of all relating data on the appropriate worksheet.

The results of QC materials must be compared to acceptable ranges and any outliers must be flagged. Once all calculations have been made, QC results evaluated, and all data recorded, the project package, including all raw data, is reviewed by the department supervisor.

The project package will include the following:

1. Work sheets with all related calculations
2. Extraction / digestion sheets with related volumes and weights
3. All instrument charts, chromatograms, and print-outs

All items in the project package must have dates when procedures are performed and the initials of the person performing the procedure. Each instrument print-out or chromatogram must be dated, initialed by the analyst, be labeled with both the unique sample number and the project number.

12.2 DATA CALCULATIONS

Final results are calculated differently depending upon the method chosen to generate the data. Methods with associated calculation types are listed in Table 12-1.

12.3 DATA VALIDATION

The process of data validation involves various checks from the evaluation of sample integrity to verification of quality control values. Tables 12-2 and 12-3 list the steps of data validation and the personnel responsible for each action. Table 12-4 lists the quality control procedures and acceptable ranges.

12.4 DATA REPORTING

After the review process has been completed, the analyst or the supervisor enters the final result in the laboratory computer for reporting to the client. A unique identification code or number is assigned to each analyst and must be used to access the data entry mode of the computer. This code is permanently tagged to the data records in the computer.

Once the data is entered, the data folder may be filed numerically by project number in the department.

If all samples on the project are complete in the computer, a final results report will be printed for delivery to the client. This final report must be reviewed by the supervisors of each department, the QA officer, and the Technical Director prior to delivery to the client.

12.5 CORRECTION OF ERRONEOUS DATA

If it is recognized that erroneous data has been released to the client, the following procedure must be initiated immediately:

1. The laboratory manager is notified

2. The laboratory manager or his designee will notify the client by phone

3. An amended report will be issued

4. A detailed explanation of the error will be submitted to the QA officer and the Technical Director. Once these have been reviewed and the Technical Director's copy returned, it is filed with the project data.

12.6 DATA STORAGE

All data relating to an analytical project is stored for seven years. Computer records are archived onto optical disk. Hard copies are stored for three months in the department and finally transferred to long term storage. Data is filed in the department by project number. Long term storage is organized by analysis type and project number.

TABLE 12-1

CALCULATIONS

PROCEDURE	CALCULATION TYPE	CALIBRATION	MODE
GC / MS organics	5-point calibration	linear regression	computer
AA metals	3-point calibration	linear regression	computer
ICP metals	single point		computer
GC organics	5-point calibration	linear regression	manual
TRPH-IR	5-point calibration	linear regression	computer
Cyanide	5-point calibration	linear regression	computer
Phenolics	3-point calibration	linear regression	computer
Hardness	titration, ml of EDTA		manual
Alkalinity	titration, ml H_2SO_4		manual
BOD	direct readout from probe verified by controls		manual
COD	single point		manual
Phosphate	5-point calibration	linear regression	computer
Ammonia N	5-point calibration	log regression	manual
TOC	3-point calibration	linear regression	manual
Solids	direct determination of weight		manual

TABLE 12-2

DATA INTEGRITY

ACTION	PERSON RESPONSIBLE
Verification of sample integrity	Accessioning personnel
Chain of custody verification	Accessioning personnel
Check of sample appropriateness	Analyst
Checking of extraction logs	Analyst
Verification of calibration	Analyst
Checking raw data and calculations	Department supervisor
Checking instrument logs	Department supervisor
Completeness check	Department supervisor
Internal chain of custody	Department supervisor

TABLE 12-3

DATA VALIDATION

ACTION	PERSON RESPONSIBLE
Review of project completeness	Technical Director
Review of quality control	Quality Assurance Director
Review of supporting project documentation	Technical Director
Final project review for obvious anomalies	Technical Director Quality Assurance Director

TABLE 12-4

QUALITY CONTROL PROCEDURES

QUALITY CONTROL PROCEDURES	ACCEPTABLE RANGE
Duplicates	RPD must be within two standard deviations of the mean or all samples associated with this duplicate pair must be flagged to show poor precision.
Matrix spikes	Recovery must be within two standard deviations of the mean or all samples associated with this spike must be flagged to show poor recovery.
Method blank	Results for the method blank should not exceed the project required quantitation limit. Exceptions are made for common lab contaminants: Methylene chloride, acetone, phthalates. If the blank does show contamination the project associated with the blank must be reprepared and reanalyzed.
Laboratory control samples	The analytically determined result must be within twenty percent of the assayed value.
Surrogates	Surrogate recoveries on each sample must be within two standard deviations of the mean. If outside of the two SD range, the sample must be reprepared and reanalyzed.

13.0 CORRECTIVE ACTION

The acceptance criteria for quality control procedures is indicated in Tables 13-1 through 13-3 along with associated corrective actions. During method performance the analyst may perform corrective action as required as it relates to calibration, re-calibration, standardization, re-standard ization, or repeating the analysis. Supervisor approval is required for corrective action involving the re-preparation of extracts, preparation of new standards, purchase of new standards, determining or accepting data involving interferences, and, making requests for manufacturers service.

Corrective action may be initiated by external sources. Unacceptable performance evaluations by regulatory agencies, poor correlation on field split samples, external audits (performance or system), or questions concerning data quality by clients will lead to investigation and corrective action.

All corrective action results will be documented. If the supervisor of the analytical area performed the corrective action (e.g. initiated the purchase of new standards), then that supervisor will document the department records of this action (e.g. the standard log book). If the corrective action is initiated externally, the action will be initiated, followed to completion, and documented by the QA / QC officer. The Corrective Action Form, shown in Figure 13-1, will be the vehicle for communicating all corrective actionto supervisors, QA officer and the Technical Director.

Corrective action will always be initiated when recommended by Quality Control Agencies such as the EPA, State of Tennessee, or the State of Florida Department of Environmental Regulation.

FIGURE 13-1

CORRECTIVE ACTION FORM

"EXAMPLE"

DATE	AGENCY	ITEM	CORRECTIVE ACTION	INITIALS
3/27/89	EPA	4,4-DDT	External QC materials purchased and to be analyzed; new stds from two sources to be initiated. Results due to QA / QC officer by 5/1/89.	TJD SL

TABLE 13-1

CORRECTIVE ACTION PROCEDURES

REFERENCES	ANALYSIS	CONTROL ITEM	CRITERIA FOR ACCEPTANCE	CORRECTIVE ACTION
608 , 8080	Pesticides	Calibration	r>0.995	Repeat calibration
	PCB's	ICV	+\-10%	Repeat calibration
		CCV	+\-10%	Repeat calibration
		Method blank	<CRDL	Repeat sample set
		Matrix spikes	+\-2SD	Repeat sample set
		Duplicates	RPD +\-2SD	Repeat sample set
		LCS	+\-10%	Repeat sample set
		Surrogates	+\-2SD	Repeat sample
200.7 , 6010	ICP metals	ICV	+\-10%	Repeat calibration
		ICB	<IDL	Repeat calibration
		Method blank	<CRDL	Repeat sample set
		ICS	+\-20%	Check inter-element interface factor recalibrate
		CCV	+\-10%	recalibrate
		CCB	<CRDL	recalibrate
		Serial dilution	+\-10%	flag data
		Spike sample	+\-2SD	Repeat sample set
		Duplicate	RPD +\-2SD	Repeat sample set
200/7000	AA metals			
272.2	Ag	Calibration	r>0.995	Repeat calibration
206.2/7060	As	ICV	+\-10%	Repeat calibration
213.2/7131	Cd	ICB	<IDL	Repeat calibration
218.4/7197	Cr+6	CCV	+\-10%	Repeat calibration
218.2/7191	Cr	CCB	+\-10%	Repeat calibration
220.2	Cu	Method blank	<CRDL	Repeat sample set
239.2/7421	Pb	Analytical spike	85-115%	Run sample by MSA
270.2/7740	Se	Matrix spike	+\-2SD	Repeat sample set

204.2/7041	Sb	Duplicate	RPD +\-2SD	Repeat sample set
279.2/7841	Tl			
283.2	Ti			
245.2/7470	Hg	Calibration	r>0.995	Repeat calibration
7471		ICV	+\-10%	Repeat calibration
		ICB	<IDL	Repeat calibration
		Method blank	<CRDL	Repeat sample set
		CCB	<IDL	Repeat calibration
		Matrix spike	+\-2SD	Repeat sample set
		Duplicate	RPD +\-2SD	Repeat sample set
		CCV	+\-2SD	Repeat calibration
9010/335.2	CN	Calibration	r>0.999	Repeat calibration
9065/420.2	Phenolics	ICV	+\-10%	Repeat calibration
9060/415.1	TOC	Matrix spike	+\-2SD	Repeat sample set
410.2	COD	Method blank	<CRDL	Repeat sample set
350.3	Ammonia N	CCV	+\-10%	Repeat calibration
351.4	TKN	Duplicate	RPD +\-2SD	Repeat sample set
365.2	Phosphorus			
420.1	MBAS			
310.1	Alkalinity	Std Validation	+\-15%	Repeat calibration
405.1	BOD	Validation Std	+\-15%	Check system repeat samples
1110	Corrosivity	Control standard	+\-15%	Check system repeat samples
160	Solids	Duplicate	+\-10%	Repeat sample set
130.2	Hardness	Std Validation	+\-15%	Check system repeat sample set
9020	TOX	Cell calibration	+\-5%	Check cell repeat calibration
300	Cl, Nitrate,	Calibration	+\-5%	Repeat calibration
	Sulfate,	Duplicate	RPD +\-2SD	Repeat sample set
	Nitrite	CCV	+\-10%	Repeat calibration
	Bromide, Fluoride	Spike	+\-2SD	Repeat sample set
180.1	Turbidity	Calibration	+\-5%	Clean cell, Recalibrate
120.1 , 9050	Specific conductance	Verification standard	+\-5%	Clean cell Recalibrate
624	Volatile	BFB Tune	Table 13-2	Tune instrument Re-check BFB
		Calibration	<10%RSD	Repeat calibration
		CCS	<10%RSD of initial cell	Repeat calibration

		Blank	<CRDL	Repeat until <CRDL
		Matrix spike	+\-2SD	Repeat sample set
		Matrix spike dupl	RPD +\-2SD	Repeat sample set
		Surrogate spikes	+\-2SD	Repeat sample set
8240	Volatile organics	BFB Tune	Table 13-2	Tune instrument Re-check BFB
		Calibration	CCC's <30%RSD SPCC's RF>0.30 bromoform >0.25	Repeat calibration
		CCS	CCC's <25%RSD SPCC's >0.3 RF	Repeat initial cell
		Method blank	<CRDL	Repeat until <CRDL
		Matrix spike	+\-2SD	Repeat sample set
		Spike duplicate	+\-2SD	Repeat sample set
		Surrogate spikes	+\-2SD	Repeat sample
625	Semivolatiles	DFTPP tune	Table 13-3	Tune system Repeat DFTPP
		Calibration	<10%RSD	Repeat calibration
		CCS	<10% RSD of initial cal	Repeat initial cal
		Blank	<CRDL	Repeat until <CRDL
		Matrix Spike	+\-2SD	Repeat sample set
		Spike duplicate	RPD +\-2SD	Repeat sample set
		Surrogates	+\-2SD	Repeat sample set
8270	Semivolatiles	DFTPP Tune	Table 13-3	Tune instrument Repeat DFTPP
		Calibration	CCC's <30%RSD SPCC's RF>0.05	Repeat calibration
		CCS	CCC's <25%RSD SPCC's RF>0.05	Repeat initial cal
		Method blank	<CRDL	Repeat sample set
		Matrix spike	+\-2SD	Repeat sample set
		Matrix spike dupl	RPD +\-2SD	Repeat sample set
		Surrogates	+\-2SD	Repeat sample
601	Purgeable halocarbons	Calibration	<10% RSD	Repeat calibration
		CCS	<10% of initial cell	Repeat initial cell

		Method blank	<CRDL	Repeat until <CRDL
		Matrix spike	+\-2SD	Repeat sample set
		Matrix spike dupl	RPD +\-2SD	Repeat sample set
		Surrogates	+\-2SD	Repeat sample
8010	Purgeable halocarbons	Calibration	<20%RSD	Repeat calibration
		CCS	<15%RSD	Repeat calibration
		Method blank	<CRDL	Repeat until <CRDL
		Matrix spike	+\-2SD	Repeat sample set
		Matrix spike dupl	RPD +\-2SD	Repeat sample set
		Surrogates	+\-2SD	Repeat sample
8020 , 601	Purgeable aromatics	Calibration	<10%RSD	Repeat calibration
		CCS	<10% of initial cell	Repeat initial cell
		Blank	<CRDL	Repeat until <CRDL
		Surrogate	+\-2SD	Repeat sample
		Matrix spike	+\-2SD	Repeat sample set
		Matrix spike dupl	+\-2SD	Repeat sample set

TABLE 13-2

BFB KEY IONS AND ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
50	15-40 percent of the base peak
75	30-60 percent of the base peak
95	base peak 100% relative abundance
96	5-9 percent of the base peak
173	less than 1% of the base peak
174	greater than 50% of base peak
175	5-9 percent of mass 174
176	greater than 95 percent but less than 101 percent of 174
177	5-9 percent of mass 176

TABLE 13-3

DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

MASS	ION ABUNDANCE CRITERIA
51	30-60 percent of mass 198
68	less than 2 percent of mass 69
70	less than 2 percent of mass 69
127	40-60 percent of mass 198
197	less than 1.0% percent of mass 198
198	base ion, 100% relative abundance
199	5-9 percent of mass 198
275	10-30 percent of mass 198
365	greater than 1% of mass 198
441	present but less than mass 443
442	greater than 40% of mass 198
443	17-23 percent of mass 442

14.0 PERFORMANCE AUDITS

14.1 SYSTEM AUDITS

System audits consist of a review and evaluation of all components of laboratory operation. This will involve the assessment of compliance with all regulatory agency regulations and adherence to laboratory QA guidelines and QC procedures. Once the evaluation is complete, the evaluation sheet is reviewed by the department supervisor and the Technical Director. The reports become part of the permanent laboratory record.

14.1.1 Internal audits

Internal audits are performed semi-annually by the QA officer. The checklist used by the QA officer during the review is summarized in Table 14-1.

14.1.2 External audits

The laboratory is inspected every two years by the State of Tennessee Department of Health and Environment. Inspections by the U.S. Army Corps of Engineers (USACE) occur every 18 months.

14.2 PERFORMANCE AUDITS

Performance audit samples are submitted semi-annually by the USEPA (WS and WP series). Performance audit samples are submitted on an unscheduled basis from the USACE.

Internal blind performance audit samples are analyzed every six months.

TABLE 14-1

INTERNAL SYSTEM AUDIT CHECKLIST

I. Personnel

1.	Does the ICP spectroscopist have at least one year experience?	Y	N
2.	Does the AA spectroscopist have at least one year experience?	Y	N
3.	Does the cold vapor spectroscopist have at least nine months experience?	Y	N
4.	Do all the classical inorganic techniques analysts have at least six months experience?	Y	N
5.	Does the pesticide chemist have at least one year of experience?	Y	N
6.	Does the GC supervisor have at least two years experience?	Y	N
7.	Do all of the mass spectroscopists have at least one year of experience?	Y	N
8.	Does the chief mass spectroscopist have at least one year of experience?	Y	N
9.	Is there documentation that all analysts have proper training in procedures and QA?	Y	N

II. General laboratory Facility

1.	Is there adequate bench space in all areas?	Y	N
2.	Is the quality of the water regularly monitored and are the records in order?	Y	N
3.	Are the balances properly located and maintenance records in order?	Y	N

4.	Are all departments clean and free of clutter?	Y	N
5.	Is cold storage adequate?	Y	N
6.	Are temperature records maintained on all constant temperature devices?	Y	N
7.	Does the laboratory adhere to chemical waste policies?	Y	N
8.	Are pH meters and ion specific electrodes properly maintained?	Y	N
9.	Is the UV / VIS unit properly maintained and are records of maintenance available?	Y	N

III. Equipment and Procedures

1.	Are all procedure manuals up to date and available to all personnel?	Y	N
2.	Do the procedure manuals contain calibration protocols?	Y	N
3.	Are instrument maintenance records in order?	Y	N
4.	Do maintenance records indicate factory service?	Y	N
5.	Are instruments vented?	Y	N
6.	Are calibration records available for all instruments?	Y	N

IV. Standards

1.	Can the calibration of the instrument be traced to the NBS?	Y	N
2.	Are records kept to document the preparation of standards?	Y	N
3.	Are all standards properly labeled?	Y	N

V. Quality Control

1.	Are quality control samples being analyzed at the frequency required by the method?	Y	N
2.	Are quality control results entered into the computer system?	Y	N
3.	Is there evidence that all data is reviewed by the department supervisor before being reported?	Y	N
4.	Is there evidence of corrective action when QC results are out of range?	Y	N
5.	Are instrument logs in use and current?	Y	N

15.0 QUALITY ASSURANCE REPORTS

Quality assurance reports will be prepared quarterly by the QA officer. The reports will be reviewed by the QA officer, the Technical Director, and the departmental supervisors. All resulting actions will be documented and attached as an addendum to the report and returned to the QA officer for filing.

The quality assurance report will include the following items:

1. Accuracy and precision assessment

   Accuracy and precision will be assessed by evaluating computer generated recovery and duplicate precision data. The means and ranges will be compared to those outlined in the appropriate methods. Trends in the data base will be noted if present.

2. Method detection limits

   Method detection limits are verified and updated on a semi-annual basis. The verification process should be certified and the data resulting from the verification process should be compared to historical data as well as the data listed by the EPA in the appropriate methods.

3. System audits

   The result of the most recent system audit should be included.

4. Performance audits

   The result of the most recent blind performance audit sample set should be included with a listing of acceptable results. A review of any external performance audit sample results received since the last QC report should be included.

   Any QA / QC problems encountered since the last report will be summarized here. This will include a brief description of the problem and the corrective action taken.

The report must have the signature of the Technical Director, the QA officer, and all supervisors before filed as complete.

16.0 RESUMES

16.1 DANNY B. HALE, LAB MANAGER AND TECHNICAL DIRECTOR

16.2 THEODORE J. DUELLO, PH.D., QUALITY ASSURANCE DIRECTOR

16.3 MICHAEL H. DUNN, LABORATORY SUPERVISOR

16.4 PAUL E. LANE, JR., LABORATORY SUPERVISOR

16.5 JOHNNY A. MITCHELL, LABORATORY SUPERVISOR

16.6 RODNEY D. STREET, LABORATORY SUPERVISOR

Danny B. Hale
President & Technical Director

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION

Vanderbilt University Nashville, Tennessee
Biochemistry, 1973

University of Mississippi University, Mississippi
Master of Science, Chemistry, 1972

David Lipscomb College Nashville, Tennessee
Bachelor of Arts, Chemistry, 1970

Cumberland County high School Crossville, Tennessee
May 1966

EXPERIENCE

Specialized Assays, Inc. Nashville, Tennessee

1980 - Present
President / Technical Director
Full time employee

1980 - 1987
Specialized Assays, Inc. Nashville, Tennessee
Chief Operating Officer

1973 - 1980
International Clinical Laboratories Nashville, Tennessee
Supervisor
Supervisor of routine and automated chemistry

REFERENCES

Wayne McCoy, ERC Environmental, Nashville, Tennessee

Bill Baumgartner, W.Z. Baumgartner, Brentwood, Tennessee

Paul Langford, David Lipscomb University, Nashville, Tennessee

Theodore J. Duello, Ph.D.
QA / QC Officer

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION	**St. Louis University** St. Louis, Missouri Ph.D., Biochemistry, May 1971
	Quincy College Quincy, Illinois Bachelor of Science, Chemistry, August 1966
	Marquette High School Alton, Illinois
EXPERIENCE 1989 - Present	**Specialized Assays Inc.** Nashville, Tennessee QA / QC Officer Full time employee
1980 - 1989	**Specialized Assays, Inc.,** Nashville, Tennessee QA / QC Officer of Environmental Division, Pesticide / PCB Supervisor, Technical Director and Radiation Officer of Clinical Laboratory Division Supervising Pesticide / PCB analysis, performing limited GC / MS work, monitoring quality control throughout the lab
1977 - 1980	**International Clinical Laboratories** Nashville, Tennessee Manager of Special Chemistry Supervising special chemistry for clinical laboratory including steroid and radio-isotope procedures
1973 - 1977	**Smith - Kline** St. Louis, Missouri Chief of Chemistry Supervising, managing, and developing procedures for automated chemistry, special chemistry (atomic absorption) and toxicology

REFERENCES

Danny B. Hale, Specialized Assays, Nashville, Tennessee

Russell A. Oldfield, Jr., Specialized Assays, Nashville, Tennessee

Myron Holscher, Vanderbilt University, Nashville, Tennessee

Michael H. Dunn
Laboratory Supervisor

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION

Middle Tennessee State University Murfreesboro, Tennessee
Master of Science, Chemistry, 1985

Middle Tennessee State University Murfreesboro, Tennessee
Bachelor of Science, Chemistry, 1978

McGavock High School Nashville, Tennessee
June 1974

EXPERIENCE

1991 - Present

Specialized Assays, Inc. Nashville, Tennessee
Supervisor, Pesticides / PCB's and Miscellaneous Chemistry.
Full time employee managing analyses of pesticides, herbicides, and PCB's to SW-846; miscellaneous chemistries: TOC, TOX, inorganics, BOD, wet chemistry, etc...

1986 - 1991

Northern Telecom Nashville Tennessee
Staff Engineer
Managing materials lab and QA / QC, product testing, health and safety, waste treatment, inspection, process control, methods development.

1981 - 1986

Textron Aerostructures Nashville, Tennessee
Staff Engineer
Managing materials science lab; testing composites, metals; processing solutions, air, waste, etc.; methods development

REFERENCES

Dr. Gale Clark, Middle Tennessee State University
Murfreesboro, Tennessee

Ed Rawlings, Quaker Chemical

Ed Durham, Textron Aerostructures

Paul E. Lane, Jr.
Laboratory Supervisor

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION

University of Tennessee - Knoxville Knoxville, Tennessee
Bachelor of Arts, Chemistry and Biology
Summa Cum Laud, 1984

Martin Marietta Oak Ridge, Tennessee
Research Projects, 1984

Rogersville High School Rogersville, Tennessee
May 1980

EXPERIENCE

1987 - Present

Specialized Assays, Inc. Nashville, Tennessee
Ancillary Services Supervisor, Organic Prep Supervisor
Full time employee
Supervising organic prep, client services, tracking of all laboratory samples including: sample enter and priority placing for the laboratory

1985 - 1987

I.T. Corporation Knoxville, Tennessee
Organic Prep Supervisor
Supervising organic prep operations, daily and planned sample flow

REFERENCES

I.T. Corporation, Knoxville, Tennessee

Dr. Les Hickock, University of Tennessee
Knoxville, Tennessee

Dr. A. E. Etinier, University of Tennessee
Knoxville, Tennessee

Johnny A. Mitchell
Laboratory Supervisor

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION

University of Mississippi University, Mississippi
Pharmacology, 1987

David Lipscomb College Nashville, Tennessee
Bachelor of Science, Biochemistry 1984

Ezell-Harding Christian School Antioch, Tennessee
June 1980

EXPERIENCE

1989 - Present

Specialized Assays, Inc. Nashville, Tennessee
Supervisor, GC / MS Laboratory
Full time employee
Supervisor of all analytical activity in the GC / MS laboratory. Responsible for four mass spectrometers performing environmental analyses according to USEPA methodologies. Position also involves maintenance and servicing of instruments and adherence to all Laboratory QA / QC procedures.

1988 - 1989

St. Jude Children's Research Hospital, Department of Pharmacology Memphis, Tennessee
Research Technologist
Active in the continuing research into the biochemical and pharmacological effects of antieoplastics. Experienced in tissue preparation, aseptic technique, enzyme purification and kinetics, multiple spectrophotometric and chromatographic techniques.

1984 - 1988

University of Mississippi, Department of Pharmacology
University, Mississippi
Research assistant
Responsible for both conception and performance of various laboratory projects, supervision of laboratory personnel, analysis of data, presentation and publication of results. Duties also included teaching laboratory and lecture courses within the School of Pharmacy.

REFERENCES

Dr. Raymond Blakely, St. Jude Children's Hospital
Memphis, Tennessee

Dr. I .W. Waters, University of Mississippi
University, Mississippi

Dr. D.O. Johnston, David Lipscomb College
Nashville, Tennessee

Rodney D. Street
Laboratory Supervisor

Specialized Assays, Inc.
300 12th Avenue South
Nashville, Tennessee 37203
(615) 726-0177

EDUCATION

University of Alabama in Birmingham Birmingham, Alabama
Bachelor of Science, Medical Technology, 1975

Etowah High School Gasden, Alabama
June 1971

EXPERIENCE

1980 - Present

Specialized Assays, Inc. Nashville, Tennessee
Supervisor of Metals Laboratory
Full time employee.

1975 - 1980

Vanderbilt Hospital Nashville, Tennessee
Medical Technologist

SPECIAL

Licensed for Medical Laboratory, State of Licensing
Tennessee 1975

Nationally registered for ASCP, 1975

REFERENCES

Danny B. Hale, Specialized assays, Nashville, Tennessee

Russell A. Oldfield, Specialized Assays, Nashville, Tennessee

APPENDIX IV

APPENDIX IV

DECONTAMINATION PROCEDURES

DECONTAMINATION PROCEDURES

Cleaning and decontamination of all equipment shall occur either at a permanent designated site decontamination pad, or at temporary designated decontamination areas to be designated based on site specific conditions, including access considerations. The permanent decontamination site will be constructed in a " berm" manner to allow collection and containment of decon fluids. The decon waters will be pumped into a designated holding tank for characterization and disposal. Portable decon systems (pods) may be constructed to expedite decontamination of sampling equipment while performing excavation activities. Fluids from the portable system(s) will be pumped to the designated holding tank.

Introduction

A portion of the area located south of the LTD body shop is considered as the site for the permanent decon facility for equipment and/or personnel. Personnel decon stations will be constructed in the Support Zone of each activity area.

All equipment, sampling devices, and personnel which come in contact with potentially contaminated materials, soil or water, at the Site will be decontaminated. At a minimum, these decontamination procedures shall consist of washing with detergent and rinsing with water. More stringent decontamination procedures will be required for sampling or specialized field equipment.

General Procedures To Be Utilized During Decontamination

The following general procedures will be used in the field during decontamination operations.

1. At a minimum, modified Class D Personal Protective Equipment (PPE) will be used by all decon personnel when performing decon procedures on excavation and soil/water sampling equipment.
2. Personnel decon will be performed by site personnel dressed in PPE one level lower than that required in the work zone; *i.e.*, if Class B PPE is required in work zone, Class C

PPE will be worn by the decontamination personnel. If Class C is required in the work zone, Class D will be the uniform for decon personnel.

3. Decontamination of equipment will require the use of a high pressure steam washer followed by a triple potable rinse.
4. Portable sampling equipment used in the work zone will be logged and deconned to minimize equipment damage.

Heavy Equipment Decontamination

All excavation equipment (trackhoes/backhoes) and other similar equipment involved in the excavation and sampling activities shall be cleaned and decontaminated prior to performing site activities. All equipment will be inspected before entering the Site to ensure there are no fluids leaking and that all gaskets and seals are intact. The preactivity decontamination of the equipment entering the Site is necessary to prevent cross-contamination of site samples due to contamination from other sites. All heavy equipment and sampling equipment will be thoroughly cleaned and decontaminated at the designated permanent cleaning/decontamination area.

All trenching and associated equipment that will come into contact with the excavation trenches will be cleaned and decontaminated following these procedures:

1. Clean with tap water and phosphate free detergent using a brush, if necessary, to remove particulate matter and surface films. Steam cleaning will be used to remove matter that is difficult to remove with the brush. Equipment which have holes that transmit fluids shall be cleaned on the inside and outside, *i.e.*, hoses, pumps, etc.
2. Equipment will be tripled rinsed with potable waters available at the site.
3. All portable, handheld sampling equipment, *i.e.*, drill rods, shelby tubes, etc., will be triple rinsed with distilled water.
4. Sampling equipment which is to be stored on-site will be wrapped with clean plastic and/or aluminum foil if there is potential of contamination from other operations.

Proper Disposal of Decontamination Liquids

All liquids generated during the decontamination of excavation and/or sampling equipment and personnel will be collected, characterized, and disposed appropriately.

Trenching/Sampling Equipment Decontamination Procedures

Trenching activities performed on the Site require the use of two (2) major pieces of equipment:

1. Trackhoe
2. Rubber-tired backhoe with front end loader

Excavating equipment used for sampling will be initially decontaminated following the heavy equipment decon procedures above. Trench soil samples will be collected from the center of the "bucket". This will insure representatives sampling from each lift. Decontamination of the "bucket" between the proposed five foot lifts will not be required unless deemed necessary by the project geologist. If between lift decon is necessary the bucket and beam will be placed over portable decon facilities located within the working limit of the equipment and scrapped, steam cleaned, and rinsed with distilled waters (triple rinsed) prior to continuing site excavation and sampling. All efforts will be made by the equipment operator to remove soils and debris from the bucket prior to deconning. Backhoe activities will primarily focus on movement of debris to facilitate safe and efficient stockpiling of excavated materials. The backhoe bucket will require similar decontamination in the event haz/nonhaz material segregation is required in the area of the OWS characterization activities, *i.e.*, hazardous debris, will not be mixed with nonhazardous debris during segregation.

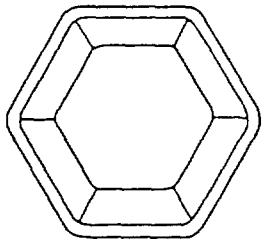
APPENDIX V

PHASE ONE

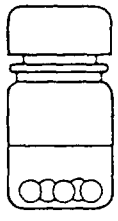
COMPONENTS FOR EXTRACTION & SAMPLE PREPARATION

Assemble the following components:

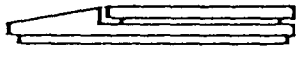
- ☐ Weigh boat
- ☐ Pan balance
- ☐ Wooden spatula
- ☐ Sample extraction jar
- ☐ Filtration barrel
- ☐ Filtration plunger
- ☐ Bulb pipette
- ☐ Enzyme dropper



Weigh Boat

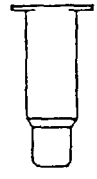


Sample extraction jar



Pan balance

Filtration plunger



Filtration barrel

Wooden spatula

Bulb pipette

Enzyme dropper

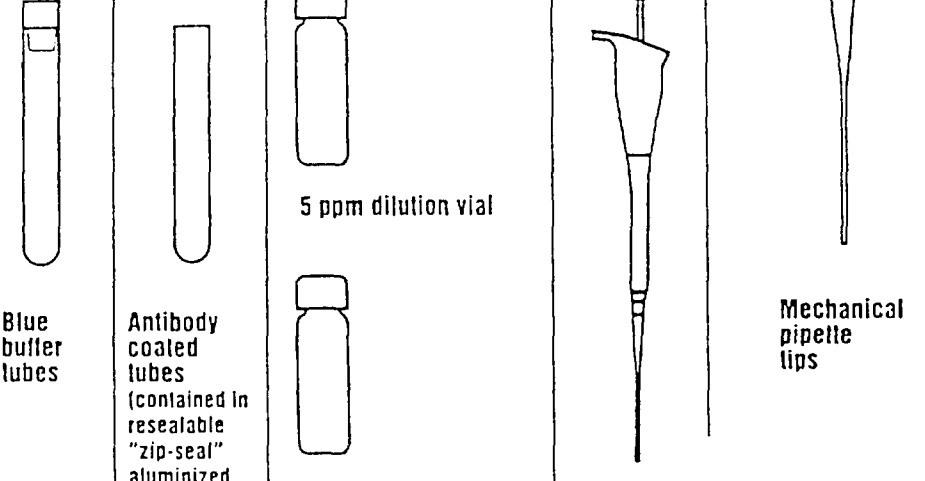
PHASE TWO
COMPONENTS FOR DILUTION OF SAMPLE & STANDARDS

Use the following component from Phase One:

- ☐ Filtered sample

Use the following additional components:

- ☐ Permanent marking pen (not included in test)
- ☐ 3 blue buffer tubes
- ☐ 3 antibody coated tubes
- ☐ Dilution vial marked "5"
- ☐ PCB standard vial marked "PCB Standard"
- ☐ Mechanical pipette
- ☐ 2 mechanical pipette tips



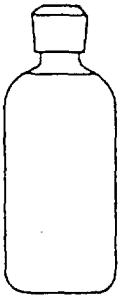
PHASE THREE
COMPONENTS FOR IMMUNOASSAY & COLOR DEVELOPMENT

Use the following components from earlier phases:

- ☐ Foam workstation
- ☐ Blue buffer tube marked "S"
- ☐ Blue buffer tube marked "Standard 1"
- ☐ Blue buffer tube marked "Standard 2"
- ☐ Antibody coated tube marked "S"
- ☐ Antibody coated tube marked "Standard 1"
- ☐ Antibody coated tube marked "Standard 2"
- ☐ Enzyme dropper
- ☐ Laboratory tissue (not included)

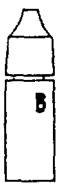
Use the following additional components:

- ☐ Wash bottle
- ☐ Liquid waste container (not included)
- ☐ Stop watch or timer
- ☐ Substrate A (yellow cap)
- ☐ Substrate B (green cap)
- ☐ Stop Solution (red cap)



Wash bottle

Substrate A



Substrate B

Stop

PHASE FOUR
COMPONENTS FOR INTERPRETING TEST RESULTS

Use the following components from earlier phases:

- ☐ Foam workstation
- ☐ Antibody coated tube marked "S"
- ☐ Antibody coated tube marked "Standard 1"
- ☐ Antibody coated tube marked "Standard 2"
- ☐ Laboratory tissue (not included)

Use the following additional component:

- ☐ Photometer

System Description

Each PCB RISc Soil Test System contains enough material to perform four complete tests, each at **5** ppm.

The PCB RISc Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with each phase.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-242-RISC (7472).

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

PCB-free soil and soil containing 5 ppm of PCBs were tested with the EnSys PCB RISc analytical method. The method correctly identified 95% of these samples. A sample that has developed less color than the standard is interpreted as positive. It contains PCBs. A sample that has developed more color than the standard is interpreted as negative. It contains less than 5 ppm PCBs.

The company does not guarantee that the results with the PCB RISc Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

EnSys, Inc. warrants that this product conforms to the descriptions contained herein. No other warranties, whether expressed or implied, including warranties of merchantability and of fitness for a particular purpose shall apply to this product.

EnSys, Inc. neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein.

Under no circumstances shall EnSys, Inc. be liable for incidental or consequential damages resulting from the use or handling of this product.

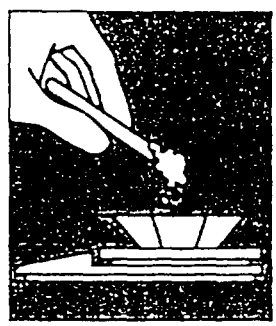
PHASE ONE

EXTRACTION & PREPARATION OF THE SAMPLE

NOTES BEFORE PROCEEDING WITH PHASE ONE

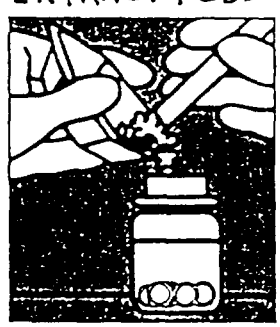
- Items that you will need that are not provided in the test kit include: a permanent marking pen, laboratory tissue, a timer or stopwatch, liquid waste container, and disposable gloves.

WEIGH SAMPLE



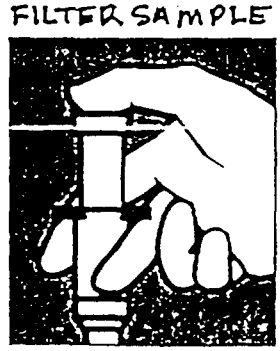
1. Place weigh boat on pan balance.
2. Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.
3. Weigh out 10 +/- 0.1 grams of soil.
4. If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

EXTRACT PCBs



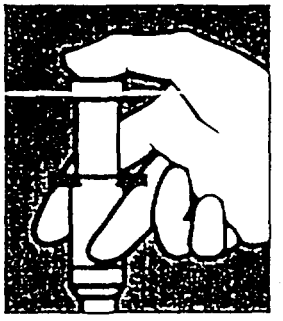
5. Remove lid from extraction jar and transfer 10 grams of soil from weigh boat into extraction jar.
6. Recap extraction jar tightly and shake vigorously for one minute.
7. Allow to settle for one minute.

FILTER SAMPLE



8. Remove lid from extraction jar.
9. Disassemble filtration plunger from filtration barrel.
10. Insert bulb pipette into top (liquid) layer in the extraction jar and draw up sample. Transfer at least ½ bulb capacity into filtration barrel. Do not use more than one full bulb.
11. Press plunger firmly into barrel until at least ½ mL of filtered sample is available (place on

FILTER SAMPLE



8 Remove lid from extraction jar.

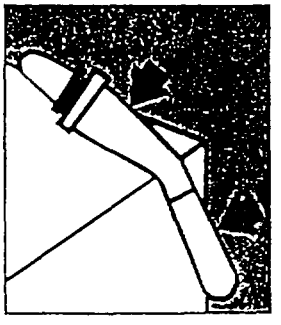
9 Disassemble filtration plunger from filtration barrel.

10 Insert bulb pipette into top (liquid) layer in the extraction jar and draw up sample. Transfer at least ½ bulb capacity into filtration barrel. Do not use more than one full bulb.

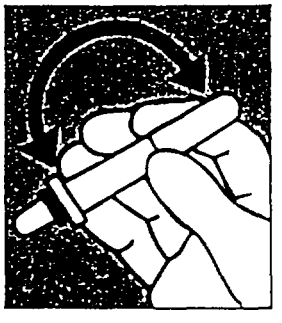
11 Press plunger firmly into barrel until at least ½ mL of filtered sample is available (place on table and press if necessary).

Sample is now ready to be tested with the immunoassay.

PREPARE ENZYME DROPPER



12 Crush glass ampule contained within enzyme dropper by pressing tube against hard edge.



13 Mix enzyme by turning dropper end-over-end 5 times. Do not shake.

14 Remove seal from enzyme dropper.

PHASE TWO

DILUTION & BUFFERING OF SAMPLE & STANDARDS

Following completion of Phase Two steps, proceed directly with Phase Three.

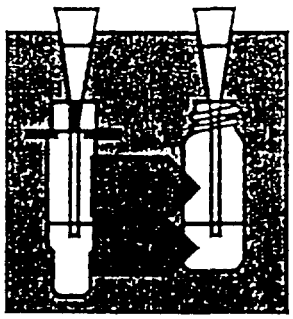
NOTES BEFORE PROCEEDING WITH PHASE TWO

- Using a permanent marking pen (not included), write **Standard 1** near the top of one blue buffer tube and one antibody coated tube. Then, write **Standard 2** near the top of one blue buffer tube and one antibody coated tube. Place the **Standard** tubes in the workstation.

- **For each sample to be tested:**
  Place one **5** ppm dilution vial in the workstation.
  Write **5 ppm** near the top of one blue buffer tube and one antibody coated tube.

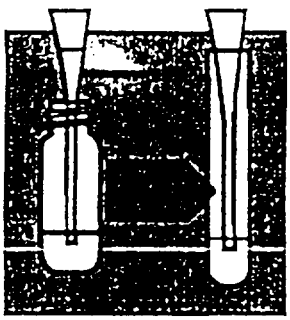
- Following instructions on reverse of insert, assemble new tip onto mechanical pipette.

DILUTE AND BUFFER SAMPLE



15 Remove cap from **5** ppm dilution vial.

16 Withdraw 30 µL of filtered sample using mechanical pipette and dispense below the liquid level in **5** ppm dilution vial. Then, withdraw another 30 µL of filtered sample and dispense below the liquid level into the same **5** ppm dilution vial for a total of 60 µL; replace cap and gently shake vial for 5 seconds.

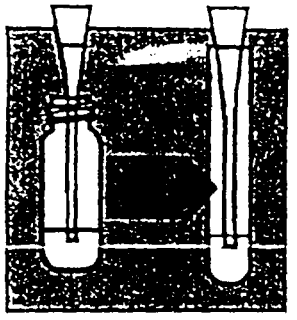


17 Remove cap from **5** ppm blue buffer tube.

18 Withdraw 30 µL of diluted sample from **5** ppm dilution vial and dispense below the liquid level in **5** ppm blue buffer tube. Do not recap blue buffer tube.

19 Gently shake **5** ppm blue buffer tube for 5 seconds.

20 Discard mechanical pipette tip.



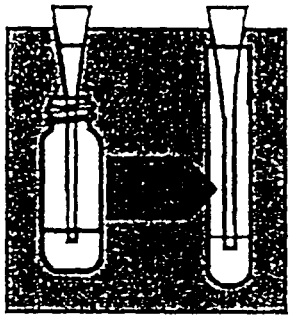
17 Remove cap from **5** ppm blue buffer tube.

18 Withdraw 30 µL of diluted sample from **5** ppm dilution vial and dispense below the liquid level in **5** ppm blue buffer tube. Do not recap blue buffer tube.

19 Gently shake **5** ppm blue buffer tube for 5 seconds.

20 Discard mechanical pipette tip.

BUFFER STANDARDS



21 Assemble new tip onto mechanical pipette.

22 Remove tops from PCB Standard vial and two blue buffer tubes marked **Standard 1** and **Standard 2.**

23 Withdraw 30 µL of PCB Standard and dispense below the liquid level in **Standard 1** blue buffer tube.

24 Wipe pipette tip with laboratory tissue.

25 Withdraw 30 µL of PCB standard and dispense below the liquid level in **Standard 2** blue buffer tube.

26 Immediately replace cap on PCB Standard vial.

27 Discard mechanical pipette tip.

28 Gently shake **Standard 1** and **Standard 2** blue buffer tubes for 5 seconds.

PHASE THREE

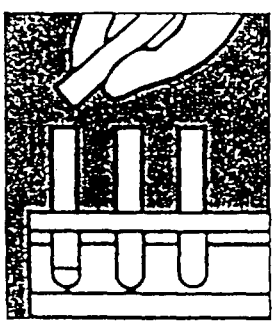
THE IMMUNOASSAY

Note: The timing used in performing Phase Three steps is critical to obtaining accurate test results.

NOTES BEFORE PROCEEDING WITH PHASE THREE

- This phase of the procedure requires critical timing and care in handling the antibody coated tubes.
- Instructions to gently shake any of the vials mean to gently but thoroughly mix the contents with special care not to spill or splash.
- All washing must be done thoroughly and with force to remove all unbound material. The wash solution is a harmless, dilute solution of detergent. Do not hesitate to wash vigorously even if the solution contacts gloved hands.

INCUBATION 1



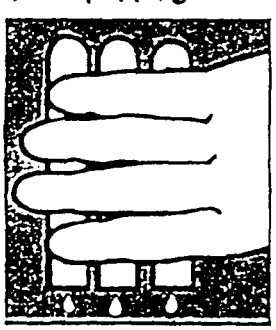
29 Start timing and immediately pour solution from each **Standard** blue buffer tube (1 and 2) into appropriate **Standard** antibody coated tube.

30 Pour solution from **5** ppm blue buffer tube into **5** ppm antibody coated tube.

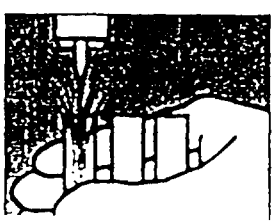
31 When pouring is complete, gently shake all 3 tubes for 5 seconds.

32 Let tubes stand exactly 10 minutes.

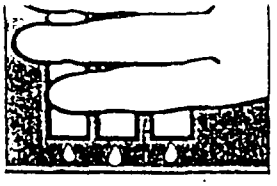
WASHING 1

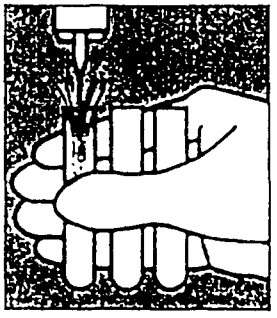


33 After the 10 minute incubation, discard solution from each antibody coated tube into liquid waste container.



34 Keeping nozzle of wash solution bottle just above top of antibody coated tube, forcefully squeeze wash solution into tube with a strong, vigorous stream to fill each tube. Empty all 3 washed tubes into liquid waste container. Repeat wash 3 times (total of 4 washes).

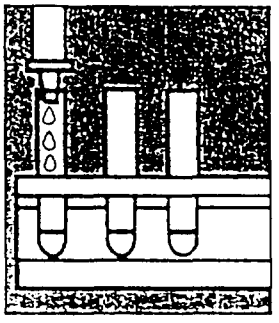




34 Keeping nozzle of wash solution bottle just above top of antibody coated tube, **forcefully** squeeze wash solution into tube with a strong, vigorous stream to fill each tube. Empty all 3 washed tubes into liquid waste container. Repeat wash 3 times (total of 4 washes).

35 After final wash, tap antibody coated tubes upside down on a laboratory tissue.

INCUBATION II

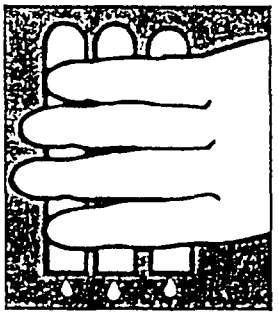


36 Remove cap and dispense first drop from enzyme dropper into liquid waste container.

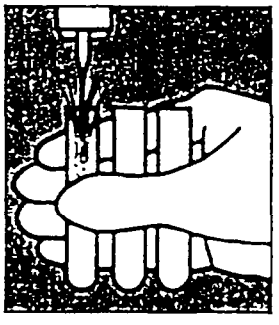
37 Start timing and immediately dispense 4 drops into each antibody coated tube (**Standards** and **Sample**) by squeezing the dropper. When complete, gently shake antibody coated tubes for 5 seconds.

38 Let tubes stand exactly 5 minutes.

WASHING II



39 After the 5 minute incubation, discard solution from each antibody coated tube into liquid waste container.



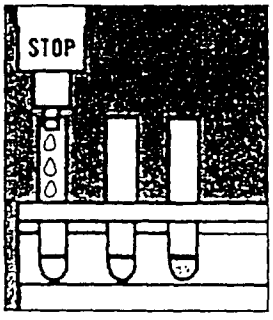
40 Keeping nozzle of wash solution bottle just above top of antibody coated tube, **forcefully** squeeze wash solution into each tube with a strong, vigorous stream to fill each tube. Empty all 3 washed tubes into liquid waste container. Repeat wash 3 times (total of 4 washes).

41 After final wash, tap antibody coated tubes upside down on a laboratory tissue.

PHASE THREE (CONT.)

COLOR DEVELOPMENT

COLOR DEVELOPMENT



42 Remove top from Substrate A (yellow cap).

Note: Keep Substrate dropper bottles vertical and direct each drop at bottom of antibody coated tubes. Addition of more or less than indicated number of drops (of Substrate A or B) may give inaccurate results.

43 Add 5 drops of Substrate A to each antibody coated tube.

44 Remove top from Substrate B (green cap).

45 Start timing and immediately add 5 drops of Substrate B to each antibody coated tube.

46 Shake all 3 tubes for 3-5 seconds, and let stand for **exactly** 2 ½ minutes. Solution will turn blue in some or all antibody coated tubes.

47 Stop reaction at end of 2 ½ minutes by adding 5 drops of Stop Solution (red cap).

Note: Blue solution will turn yellow when Stop Solution is added.

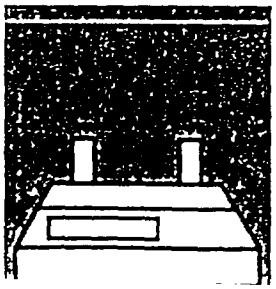
PHASE FOUR

INTERPRETING TEST RESULTS

NOTES BEFORE PROCEEDING WITH PHASE FOUR

- In this step, the standards are evaluated first in order to identify which is darker. To be conservative, the sample will be measured against the darker of these two standards.

SELECT STANDARD



48 Wipe outside of **Standard 1** and **Standard 2** antibody coated tubes with laboratory tissue.

49 Place both **Standard** tubes in photometer.

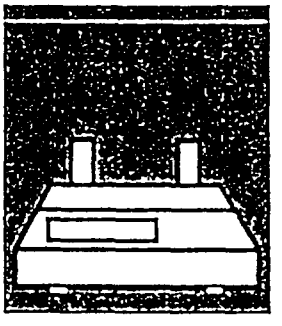
50 If photometer readout is negative or zero, the tube in the left well is the darker standard. Remove tube from right well and discard it.

PHASE FOUR
INTERPRETING TEST RESULTS

NOTES BEFORE PROCEEDING WITH PHASE FOUR

- In this step, the standards are evaluated first in order to identify which is darker. To be conservative, the sample will be measured against the darker of these two standards.

SELECT STANDARD



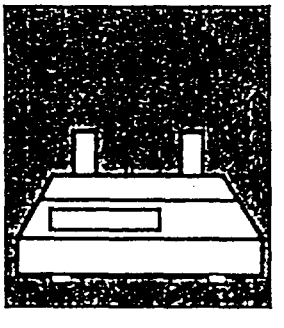
48 Wipe outside of **Standard 1** and **Standard 2** antibody coated tubes with laboratory tissue.

49 Place both **Standard** tubes in photometer.

50 If photometer readout is negative or zero, the tube in the left well is the darker standard. Remove tube from right well and discard it.

However
If photometer reading is positive, the tube in the right well is the darker standard. Remove tube from left well, discard it, and move tube from right well to left well.

MEASURE SAMPLE



51 Wipe outside of **5** ppm antibody coated tube with laboratory tissue.

52 Place **5** ppm tube in right well of photometer and record reading shown on display.

If photometer reading is negative or zero, PCBs are present.

If photometer reading is positive, concentration of PCBs is less than **5** ppm.

Standard Operating Procedures
Calibration of MicroTIP IS-3000 Photoionization Detector (PID)

Standard Operating Procedures
Calibration of MicroTIP IS-3000 Photoionization Detector (PID)

The MicroTIP IS-3000 Photoionization Detector (PID) measures the concentration of airborne photoionizable gases and vapors which ionize at 10.6 eV (electron-volts) or less. It does not distinguish between individual pollutants. The reading displayed represents the total concentration in parts per million (ppm) of all photoionizable chemicals present in the volume of air/gas/vapor sampled.

It is imperative that liquids are not sucked into the unit. The MicroTIP PID will be charged at the end of each day. A fully charged battery powers the MicroTIP for seven (7) hours. The MicroTIP will display "Lo Bat" when the battery requires recharging. Use only the IS-3000 battery charger to recharge the battery.

The MicroTIP must be calibrated in order to display concentrations in units equivalent to ppm. The MicroTIP PID will be calibrated each day prior to use. The following instructions will be followed when calibrating the MicroTIP PID.

First a supply of zero air, which contains no ionizable gases or vapors, is used to set MicroTIP's zero point. Then, span gas, containing a known concentration of a photoionizable gas or vapor, is used to set the sensitivity.

Usually clean ambient air will be suitable as zero air. If there is any doubt, use a commercial source of zero grade air and a second sampling bag. Span gas of the desired compound and concentration, required for calibration, will be on site at all times.

Isobutylene at 100 ppm in air is recommended as span gas. To calibrate the instrument use the Calibration Kit (Photovac Part No.390033) as follows:

1. Connect the supplied regulator to the span gas cylinder. Hand tighten the fittings. Observe proper handling techniques for all gases.

2. Open the valve on the gas bag by turning the valve stem fully counterclockwise.
3. Attach the nut to the regulator. Hand tighten the fittings.
4. Turn the regulator knob counterclockwise about half a turn to start the flow of gas.
5. Fill the gas bag about half full and then close the regulator fully clockwise to turn off the flow of gas.
6. Disconnect the bag from the adapter and empty it. Flush the bag a few times with the span gas and then fill it.
7. Close the gas bag by turning the valve clockwise.
8. Press SETUP and select the desired Cal Memory with the arrow keys and press ENTER. Press EXIT to return to normal display.
9. Press CAL and enter the desired response factor. Use Table 2, on page 21, to find the correct response factor for the compound of interest. If the compound is not in Table 2 or you are not looking specifically for one compound then enter 1.00.

   The concentration detected by MicroTIP will be multiplied by the response factor before it is displayed and logged.
10. Expose MicroTIP to zero air. Press ENTER and MicroTIP sets its zero point.
11. MicroTIP then asks for the span gas concentration. Enter known span gas concentration and then connect the span gas bag adapter to the inlet.
12. Press ENTER and MicroTIP sets its sensitivity.
13. When MicroTIP's display reverts to normal, MicroTIP is calibrated and ready for use. Remove the span gas bag from the inlet.

APPENDIX V

INSTRUMENTATION STANDARD OPERATION AND CALIBRATION PROCEDURES

STANDARD OPERATING PROCEDURES (SOPs)

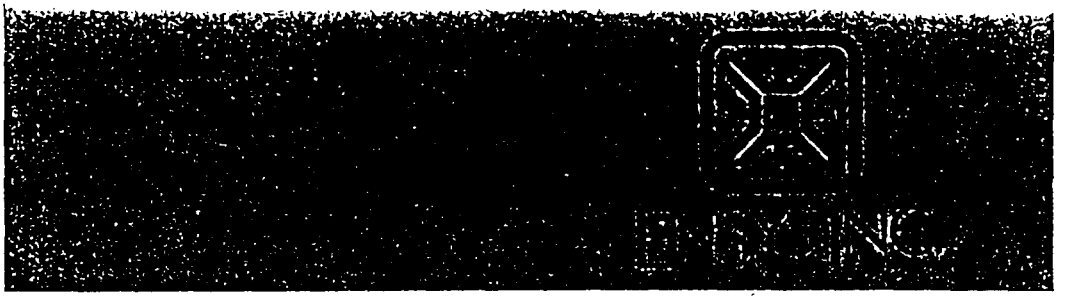
FOR PCB FIELD SCREENING

STANDARD OPERATING PROCEDURES (SOPs) FOR PCB FIELD

The following Standard Operating Procedures (SOPs) are for the ENSYS, Inc. PCB RISc™ Soil Test System. This system is capable of correctly identify 95% of soil samples that are PCB free and those containing 10 parts per million (ppm) PCBs. The directions provided here are normally provided with soil test kits set-up to test for 5 ppm PCB. The test kits used at the Saad Trousdale Drive Site (Nashville, Tennessee) will be specifically prepared by ENSYS, Inc. with a detection limit of 10 ppm. This is the Target Response Level (TRL) for the Site. All test procedures are the same and are not detection limit specific.

The test results will be positive or negative. A sample that develops less color than the standard is interpreted as positive therefore, it contains PCBs greater than or equal to 10 ppm. A sample that develops more color than the standard is interpreted as negative, *i.e.*, contains less than 10 ppm PCBs.

The PCB RISc Soil Test System performs accurately only when used as directed. The person performing the filed screening must carefully read the step by step instructions provided in this SOP to ensure accurate and successful field screening.



PCB RISC™ SOIL TEST SYSTEM

5 ppm

RAPID IMMUNOASSAY SCREEN

User's Guide

This method correctly identifies 95% of samples that are PCB-free and those containing 5 ppm of PCBs. A sample that develops less color than the standard is interpreted as positive. It contains PCBs. A sample that develops more color than the standard is interpreted as negative. It contains less than 5 ppm PCBs.

IMPORTANT NOTICE

The Test System performs accurately only when used as directed. This User's Guide is brief. Read it carefully prior to using the Test System. It will increase understanding of test objectives and help ensure a successful test.

How It Works

Standards, Samples, and color-change reagents are added to test tubes, coated with a chemical specific to PCBs. The concentration of PCBs in an unknown Sample is determined by comparing its color intensity with that of a Standard.

Note: PCB concentration is inversely proportional to color intensity; the lighter the color development of the sample, the higher the concentration of PCBs.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or test tubes from one Test System with reagents or test tubes from another Test System.
- Do not use the Test System after any portion has passed its expiration date.
- Do not attempt the test using more than 3 antibody coated tubes (two of which are **Standards**) at the same time.
- Do not exceed incubation periods prescribed by the specific steps.
- Always dispense correct number of drops and wash the number of times indicated in this guide.
- Use EPA Method 8080 or Code of Federal Regulations Title 40, Part 136, Appendix A, Method 680 to confirm results.

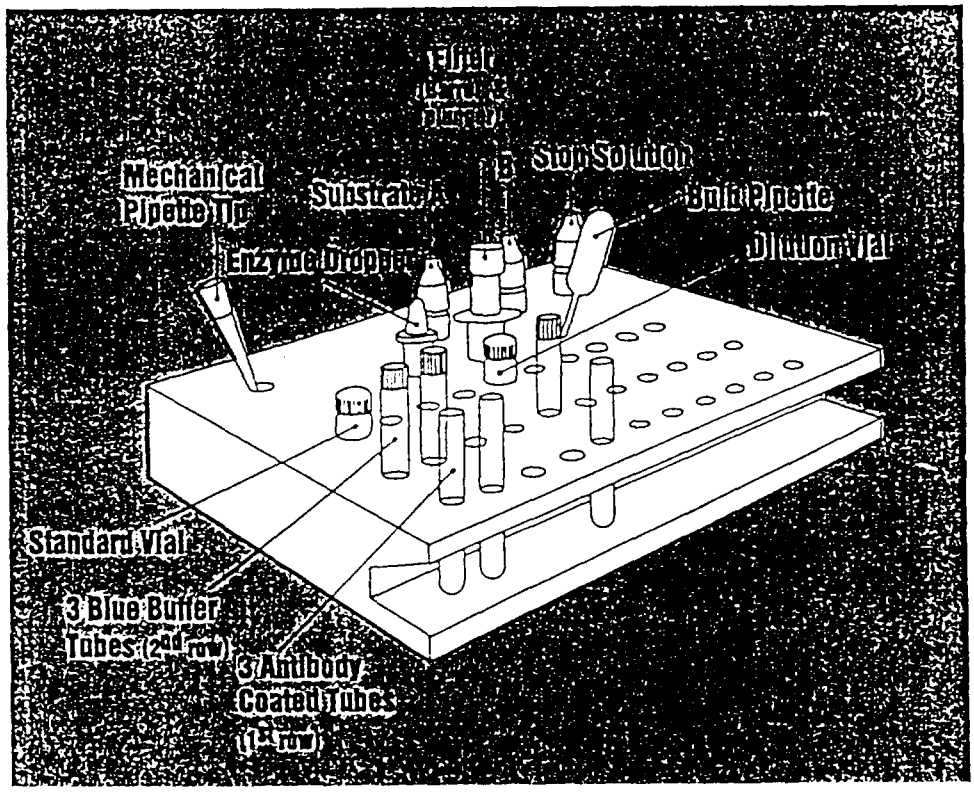
Storage and Handling Precautions

- Wear protective gloves and eyewear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- Keep aluminized pouch (containing unused antibody coated tubes) sealed when not in use.
- If Stop Solution or liquid from the extraction jar comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- If Stop Solution or liquid from the extraction jar comes into contact with skin or clothing, wash thoroughly with cold water.
- Standard Solution contains PCBs. Test samples may contain PCBs. Handle with care.

WORKSTATION SET-UP

Assemble the following components in the workstation:

- ☐ 3 antibody coated tubes
- ☐ PCB standard vial
- ☐ Enzyme dropper
- ☐ Bulb pipette
- ☐ Substrate A
- ☐ Stop solution
- ☐ 3 blue buffer tubes
- ☐ 5 ppm dilution vial
- ☐ Filtration barrel & plunger
- ☐ 2 mechanical pipette tips
- ☐ Substrate B



2 4 9772

de maximis, inc.

9041 Executive Park Drive
Suite 401
Knoxville, TN 37923
(615) 691-5052

July 14, 1992

Fred B. Stroud - OSC
USEPA Region IV
345 Courtland Street, NE
Atlanta, GA 30365

Subject: Saad Trousdale Drive Site
Removal Action/Field Investigation Phase II Work Plan

Dear Mr. Stroud:

Pursuant to our previous conversations and the Administrative Order by Consent dated May 15, 1992, enclosed are three (3) copies of the Removal Action Field Investigation Phase II Work Plan for the Saad Trousdale Drive Site in Nashville, Tennessee. Two (2) copies are being sent directly to Beth Davis. This Work Plan was prepared by DRE Geologic Services, Inc. and is submitted on behalf of the Saad Site Steering Committee for your review and approval.

If you or your staff have questions regarding this Work Plan, please contact me at (615) 691-5052.

Best regards,

Bennie L. Underwood
Project Coordinator

BLU/mdm

cc: Beth Davis, USEPA ORC
Saad Site Executive Committee

File:RAFI.ltr/dsk/11/3034